

BETAflam® Fire Resistant Safety Cables



The Quality Connection



CABLE JOINTS, CABLE TERMINATIONS, CABLE GLANDS, CABLE CLEATS
FEEDER PILLARS, FUSE LINKS, ARC FLASH, CABLE ROLLERS, CUT-OUTS

11KV 33KV CABLE JOINTS & CABLE TERMINATIONS
FURSE EARTHING
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LEONI



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Your personal customer number

To offer you a more efficient service, we kindly ask you to mention your personal customer number for each order.



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Safety instructions

Cables are to be used for designed applications only. In case of failure or damage to the cable or connector switch off power immediately and replace all damaged parts. Maintenance, repair and replacement of the cables and connectors must be carried out by authorised and trained personnel only.

All information concerning material properties, fire performance, construction, electrical and technical data, prices etc. are in accordance with our present-day standard of knowledge and are without obligation. Dimensions and weights are reference values. All indications may alter any time without prior notice.

We refer to our general conditions of sales and delivery. See www.leoni-studer.ch.

Waiver

While the information contained in this flyer has been carefully compiled to the best of our present knowledge, it is not intended as representation or warranty of any kind on our part regarding the suitability of the products concerned for any particular use or purpose and neither shall any statement contained herein be construed as a recommendation to infringe any industrial property rights or as a license to use any such rights. The suitability of each product for any particular purpose must be checked beforehand with our specialists.

Our policy is one of continuous material and product development. We reserve the right to offer alternatives consistent with our manufacturing programme at the time of enquiry. All information concerning material properties, fire performance, construction, electrical and technical data, prices etc. are in accordance with our present-day standard of knowledge and are without obligation. Dimensions and weights are reference values. All indications may alter any time without prior notice.

We refer to our general conditions of sales and delivery. See www.leoni-studer.ch.

RoHS Compliance

We confirm that all products listed in this catalogue, are fully compliant manufactured with the EU Directive 2002/95/EG (RoHS) as of the 1st January 2006.

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LEONI – The Quality Connection. What connects us.

LEONI – Expertise in Communication & Infrastructure

LEONI is a strong company group with over 47,000 employees scattered across 95 locations in 36 different countries. Entrepreneurial far-sightedness, top quality and a high level of innovation have made us a leading cable system provider for the automobile and other industries. LEONI develops and produces sophisticated technical products from single core vehicle wiring up to complex on board power supply systems and provides the associated services. Moreover, the range of services includes wires and braid, standardised and special cables plus fully assembled systems for applications in various industrial markets.

Your markets – our strengths

As diverse as the range of products and services is, so varied are the markets and sectors that LEONI supplies. Our activities are concentrated on customers in the markets

Automotive, Communication & Infrastructure, Industry & Healthcare, Electrical Appliances and Conductors & Copper Solutions.

Cables, components and complete systems: Around the globe, our Communication & Infrastructure customers benefit not only from innovations but quality products that are reliable and durable. They also reap the benefits from our complete range of services involving project engineering, implementation and maintenance. That this applies equally to the skills of Europe's leading cable manufacturer for secure communication and infrastructure products should come as no surprise.

LEONI – Connecting the future.

In the Communication & Infrastructure sector LEONI bundles its products and services for data and telecommunications in offices and industrial building on the one hand. On the other, the portfolio for infrastructure projects concentrates on transportation routes, buildings, airports, rail and marine technology and major industrial plants such as oil and gas refineries. LEONI also manufactures special cables for solar parks that fulfil the two relevant international standards TÜV (Europe) and UL (America) for the entire range of products.

Safety from a single source

The Infrastructure & Datacom business unit is an internationally operating enterprise area belonging to the LEONI group. We develop and manufacture high quality cables and also process sophisticated compounds for conductor insulation. The BETAflam® brand for cables and BETAfixss® brand for laying systems are the acknowledged standards for installations in public buildings, structural and civil engineering and in transportation infrastructure plants. Thanks to the ability to continue functioning even in cases of fire our products make an important contribution in critical situations.

The halogen-free and flame retardant insulation materials used for our cables are mostly developed and produced by us. Fire tests on cables and support systems are carried out in our internal laboratories in accordance with all the pertinent standards. National and international test certificates for many components make us an attractive system provider. With competent advice and a wealth of experience we are the partner for planning engineers and fitters for the following areas:

Public buildings

Our cables and support systems supply the safety installations and evacuation routes in hospitals, schools, homes, museums etc.

Railway stations / Metro stations / Airports

Our safety cables for lighting and identifying evacuation routes and emergency exits increase the safety in infrastructure buildings.

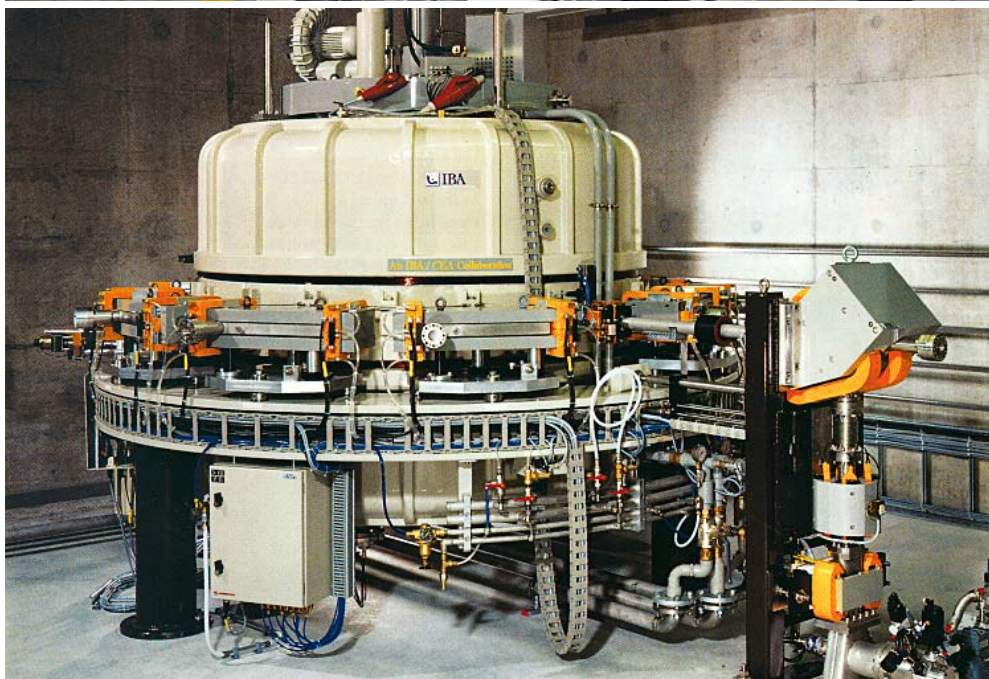
Transportation routes

Our cable and laying systems are used to safeguard the electrical supply for identifying, illuminating and controlling systems for all types of transportation route infrastructure.

Tunnels

Our cables and support systems are designed to safeguard the illumination and optical control systems and also supply ventilators and rescue routes in emergencies.





Protection to life and property is assured.

People can move about in safety.

■ Public buildings ...

Our cables and support systems energise the safety equipment and escape routes.

■ Train stations, underground stations, airports ...

Lighting, emergency exits and signalling ensure safety in infrastructure buildings. Thanks to their system integrity during exposure to fire, our products make a crucial contribution in critical situations.

■ Transport routes ...

Our products are used for the markings, illumination and control of transport routes.

■ Tunnels ...

With our cables and support systems we safeguard the lighting and optical control equipment as well as power supply to ventilators and escape routes for emergency situations.

Building and transport infrastructure nowadays have high requirements in terms of protection against disruption and fire. Developers and planners take their responsibility seriously and impose higher expectations on the safety technology of buildings such as hospitals, event facilities and office complexes. This ensures that people can escape in the event of fire and that successful firefighting minimises the damage caused. While infrastructure is presented with fresh challenges from ever more complex applications, the obligation everywhere is to provide maximum safety. Our BETAflam® products meet the key international regulations and standards in both structural and civil engineering.

We are convinced that the trend towards comprehensive safety will also be the focus of much attention in the future, and that we will make a crucial contribution in this regard with our high quality products.



Universal application with system integrity.
Safety from one source.



BETAflam® cables according to German VDE Standard

Wires and cables for highest safety requirements with circuit integrity in accordance with DIN VDE 0266

- VDE approval and surveillance
- Fire resistant
- No flame propagation
- Cross-linked by irradiation
- System circuit integrity to DIN 4102 part 12, E30 - E90
- Halogen and silicone free
- Low smoke and gas emission
- In compliance with RoHS directive
- Operating temperature 90 °C



Certificate No. 896

BETAflam® cables according to British Standard

Single and Multicore cables for highest safety requirements, in accordance with BS 6387 C.W.Z.

- LPCB approval and surveillance
- PSB Product Listing Scheme, SG
- Fire resistant / Circuit integrity
- No flame propagation
- Cross-linked by irradiation
- Halogen and silicone free
- Low smoke and gas emission
- In compliance with RoHS directive
- Operating temperature 90 °C and 110 °C



BETAflam® cables according to Swiss Standard

Single and Multicore cables for high safety requirements in accordance with SEV TP 20B/3C.

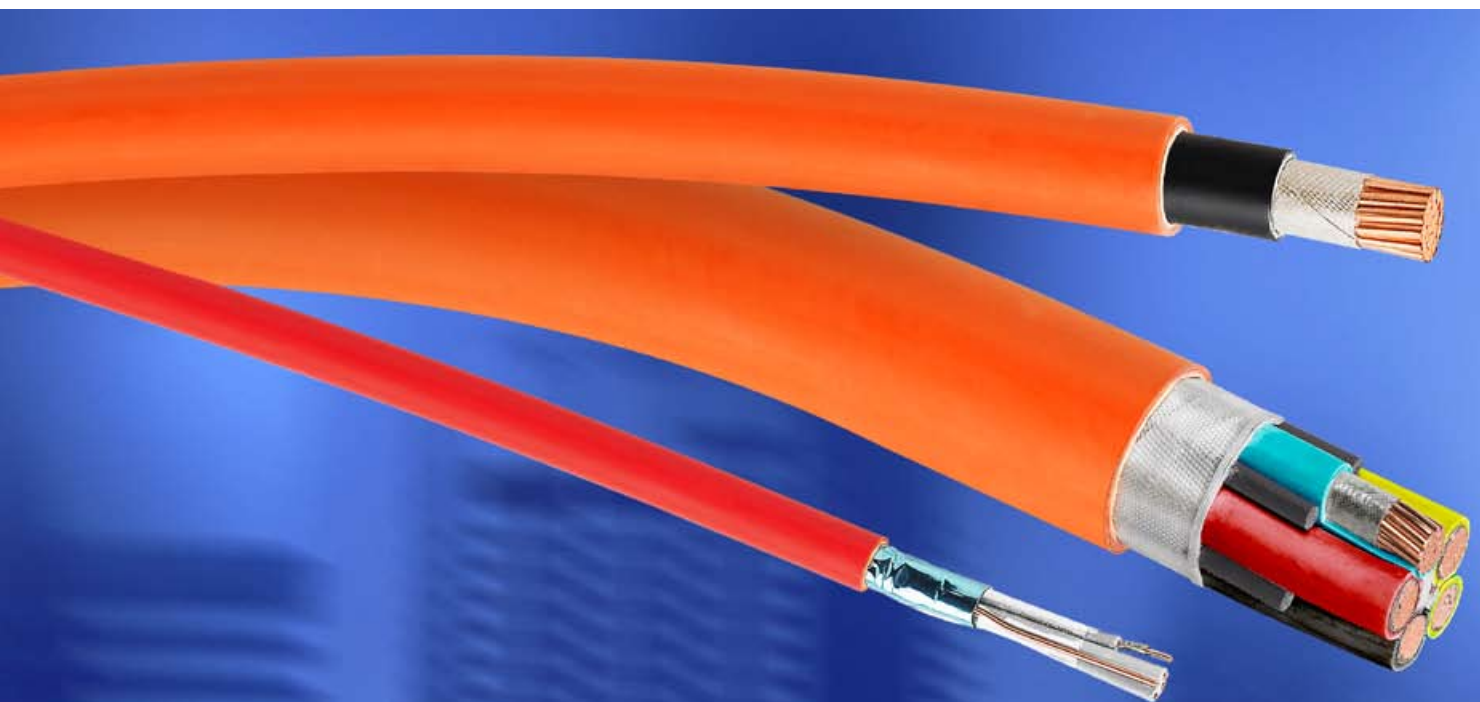
- ElectroSuisse approval
- Fire resistant / retardant
- No flame propagation
- System circuit integrity E30
- Halogen and silicone free
- Low smoke and gas emission
- In compliance with RoHS directive
- Operating temperature 90 °C



BETAfixss® cable support system with total circuit integrity in fire according to German DIN Standard

This support system is used in electrical cable installations with system integrity. They also ensure fire resistant fixing of cables laid in the area between floors as well as F30 and F90 suspended ceilings.

- DIN 4102 part 12 / ABP approval
- High quality materials
- Long laying distances
- Reduced cost of materials
- Short installation time
- One source for cables and laying system
- System circuit integrity



Overview

BETAflam®

Safety and Communication Cables

FRT-MI 90

0,6 / 1 kV
LSOH

Single Core / Single Insulated

■ page 10



Single Core / Double Insulated

■ page 14



FR-MI 90

0,6 / 1 kV
LSOH, BS 6387 C.W.Z.

Single Core / Single Insulated

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Single Core / Double Insulated

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FR-MI 110

0,6 / 1 kV
LSOH, BS 6387 C.W.Z.

Single Core / Single Insulated

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Single Core / Double Insulated

■ page 30



**FR-MI 110
armoured**

0,6 / 1 kV
LSOH, BS 6387 C.W.Z.

Multicore / Steel Tape Armour (STA)

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Multicore / Steel Wire Armour (SWA)

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FR-MI 110

300 / 500 V
LSOH, BS 6387 C.W.Z.

Comms Cables, Screened - S/UTP

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Technical information

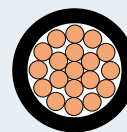
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Multicore

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BETAflam® Fire Retardant Cores & Cables

FRT-MI 90 0,6/1 kV, LSOH

Single Core / Single Insulated

Application

Use as replacement for conventional PVC wiring to reduce hazardous gas emission and avoid secondary damage in the event of fire .

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Insulation:** BETAflam® mineral copolymer
- **Core identification:** Red, Black or Green/Yellow (other colours on request)

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 3,5 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 90 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 160 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 15 × outer Ø
Fixed installed > 10 × outer Ø
- **Laying conditions:** For electrical installation in control cabinets, switchboards or other closed cable wiring systems.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4

Advantages

- Halogen and silicone free
- Operating temperature 90 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving due to small outer diameter
- Easy to handle and economical to install

Dimensions, Weight

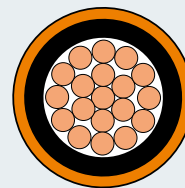
Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	302710	red	7 × 0,53	0,65	2,90	22	19	18	27,85	24,12	0,03
1,5	302485	black	7 × 0,53	0,65	2,90	22	19	18	27,85	24,12	0,03
1,5	302711	g/y	7 × 0,53	0,65	2,90	22	19	18	27,85	24,12	0,03
2,5	302712	red	7 × 0,68	0,70	3,45	33	26	24	17,08	14,79	0,04
2,5	219724	black	7 × 0,68	0,70	3,45	33	26	24	17,08	14,79	0,04
2,5	216456	g/y	7 × 0,68	0,70	3,45	33	26	24	17,08	14,79	0,04
4	302713	red	7 × 0,85	0,75	4,10	50	36	34	10,65	9,23	0,05
4	219818	black	7 × 0,85	0,75	4,10	50	36	34	10,65	9,23	0,05
4	216455	g/y	7 × 0,85	0,75	4,10	50	36	34	10,65	9,23	0,05
6	302715	red	7 × 1,04	0,80	4,60	69	46	43	7,14	6,18	0,06
6	222948	black	7 × 1,04	0,80	4,60	69	46	43	7,14	6,18	0,06
6	302716	g/y	7 × 1,04	0,80	4,60	69	46	43	7,14	6,18	0,06
10	302717	red	7 × 1,32	1,00	6,00	115	66	63	4,27	3,70	0,10
10	222949	black	7 × 1,32	1,00	6,00	115	66	63	4,27	3,70	0,10
10	216453	g/y	7 × 1,32	1,00	6,00	115	66	63	4,27	3,70	0,10
16	302719	red	7 × 1,72	1,10	7,00	174	89	85	2,71	2,34	0,12
16	222950	black	7 × 1,72	1,10	7,00	174	89	85	2,71	2,34	0,12
16	216452	g/y	7 × 1,72	1,10	7,00	174	89	85	2,71	2,34	0,12
25	302720	red	7 × 2,15	1,20	8,50	269	121	115	1,73	1,50	0,17
25	222951	black	7 × 2,15	1,20	8,50	269	121	115	1,73	1,50	0,17
25	302721	g/y	7 × 2,15	1,20	8,50	269	121	115	1,73	1,50	0,17
35	302722	red	7 × 2,52	1,30	9,80	367	152	145	1,27	1,10	0,22
35	222952	black	7 × 2,52	1,30	9,80	367	152	145	1,27	1,10	0,22
35	216450	g/y	7 × 2,52	1,30	9,80	367	152	145	1,27	1,10	0,22
50	302724	red	19 × 1,79	1,40	11,20	487	186	176	0,95	0,82	0,26
50	222953	black	19 × 1,79	1,40	11,20	487	186	176	0,95	0,82	0,26
50	216449	g/y	19 × 1,79	1,40	11,20	487	186	176	0,95	0,82	0,26
70	302725	red	19 × 2,15	1,60	13,30	697	240	230	0,68	0,59	0,36
70	222954	black	19 × 2,15	1,60	13,30	697	240	230	0,68	0,59	0,36
70	217893	g/y	19 × 2,15	1,60	13,30	697	240	240	0,68	0,59	0,36
95	302727	red	19 × 2,52	1,70	15,30	951	300	287	0,51	0,44	0,45
95	302491	black	19 × 2,52	1,70	15,30	951	300	287	0,51	0,44	0,45
95	302730	g/y	19 × 2,52	1,70	15,30	951	300	287	0,51	0,44	0,45

Ø = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
120	302731	red	37 × 2,02	1,80	17,20	1'205	353	336	0,41	0,36	0,52
120	222955	black	37 × 2,02	1,80	17,20	1'205	353	336	0,41	0,36	0,52
120	216447	g/y	37 × 2,02	1,80	17,20	1'205	353	336	0,41	0,36	0,52
150	∅	red	37 × 2,23	1,90	19,00	1'478	408	387	0,35	0,30	0,63
150	222956	black	37 × 2,23	1,90	19,00	1'478	408	387	0,35	0,30	0,63
150	∅	g/y	37 × 2,23	1,90	19,00	1'478	408	387	0,35	0,30	0,63
185	∅	red	37 × 2,49	2,00	21,00	1'829	474	449	0,29	0,25	0,74
185	302492	black	37 × 2,49	2,00	21,00	1'829	474	449	0,29	0,25	0,74
185	∅	g/y	37 × 2,49	2,00	21,00	1'829	474	449	0,29	0,25	0,74
240	∅	red	61 × 2,23	2,20	23,80	2'401	568	539	0,24	0,20	0,92
240	222957	black	61 × 2,23	2,20	23,80	2'401	568	539	0,24	0,20	0,92
240	∅	g/y	61 × 2,23	2,20	23,80	2'401	568	539	0,24	0,20	0,92
300	∅	red	61 × 2,52	2,40	27,50	3'098	668	638	0,20	0,18	1,22
300	302493	black	61 × 2,52	2,40	27,50	3'098	668	638	0,20	0,18	1,22
300	∅	g/y	61 × 2,52	2,40	27,50	3'098	668	638	0,20	0,18	1,22
400	∅	red	61 × 2,85	2,60	30,90	3'941	780	747	0,17	0,15	1,49
400	302486	black	61 × 2,85	2,60	30,90	3'941	780	747	0,17	0,15	1,49
400	222411	g/y	61 × 2,85	2,60	30,90	3'941	780	747	0,17	0,15	1,49
500	∅	red	61 × 3,20	2,80	34,40	4'950	902	865	0,15	0,13	1,80
500	302487	black	61 × 3,20	2,80	34,40	4'950	902	865	0,15	0,13	1,80
500	∅	g/y	61 × 3,20	2,80	34,40	4'950	902	865	0,15	0,13	1,80
630	∅	red	127 × 2,52	3,00	38,80	6'364	1'041	997	0,14	0,12	2,12
630	302488	black	127 × 2,52	3,00	38,80	6'364	1'041	997	0,14	0,12	2,12
630	∅	g/y	127 × 2,52	3,00	38,80	6'364	1'041	997	0,14	0,12	2,12

∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

BETAflam® Fire Retardant Cores & Cables

FRT-MI 90 0,6/1 kV, LSOH

Single Core / Double Insulated

Application

Use as replacement for conventional PVC wiring to reduce hazardous gas emission and avoid secondary damage in the event of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Insulation:** BETAflam® mineral copolymer
- **Core identification:** Black, White or Green-Yellow (other colours on request)
- **Sheath:** BETAflam® mineral copolymer, Orange (Black on request)

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 3.5 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 90 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 160 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 15 × outer Ø
Fixed installed > 10 × outer Ø
- **Laying conditions:** For fixed installation indoor, in air, trays or dry tubes/ducts.
Outdoor laying only when protected from direct sunlight and other external impacts.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4

Advantages

- Halogen and silicone free
- Operating temperature 90 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving due to small outer diameter
- Easy to handle and economical to install

Dimensions, Weight

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	∅	white	7 × 0,53	0,65	2,90	0,95	4,80	40	23	21	27,88	24,14	0,11
1,5	302733	black	7 × 0,53	0,65	2,90	0,95	4,80	40	23	21	27,88	24,14	0,11
1,5	∅	g/y	7 × 0,53	0,65	2,90	0,95	4,80	40	23	21	27,88	24,14	0,11
2,5	∅	white	7 × 0,68	0,70	3,45	0,95	5,35	54	31	29	17,11	14,81	0,13
2,5	302734	black	7 × 0,68	0,70	3,45	0,95	5,35	54	31	29	17,11	14,81	0,13
2,5	∅	g/y	7 × 0,68	0,70	3,45	0,95	5,35	54	31	29	17,11	14,81	0,13
4	∅	white	7 × 0,85	0,75	4,10	1,00	6,10	75	41	38	10,68	9,24	0,16
4	302735	black	7 × 0,85	0,75	4,10	1,00	6,10	75	41	38	10,68	9,24	0,16
4	∅	g/y	7 × 0,85	0,75	4,10	1,00	6,10	75	41	38	10,68	9,24	0,16
6	∅	white	7 × 1,04	0,80	4,60	1,05	6,70	99	52	47	7,17	6,20	0,19
6	302736	black	7 × 1,04	0,80	4,60	1,05	6,70	99	52	47	7,17	6,20	0,19
6	∅	g/y	7 × 1,04	0,80	4,60	1,05	6,70	99	52	47	7,17	6,20	0,19
10	∅	white	7 × 1,32	1,00	6,00	1,40	8,80	166	75	70	4,29	3,72	0,31
10	216444	black	7 × 1,32	1,00	6,00	1,40	8,80	166	75	70	4,29	3,72	0,31
10	∅	g/y	7 × 1,32	1,00	6,00	1,40	8,80	166	75	70	4,29	3,72	0,31
16	∅	white	7 × 1,72	1,10	7,00	1,40	9,80	232	99	93	2,73	2,36	0,35
16	302737	black	7 × 1,72	1,10	7,00	1,40	9,80	232	99	93	2,73	2,36	0,35
16	∅	g/y	7 × 1,72	1,10	7,00	1,40	9,80	232	99	93	2,73	2,36	0,35
25	∅	white	7 × 2,15	1,20	8,50	1,40	11,30	338	133	126	1,75	1,51	0,43
25	302738	black	7 × 2,15	1,20	8,50	1,40	11,30	338	133	126	1,75	1,51	0,43
25	∅	g/y	7 × 2,15	1,20	8,50	1,40	11,30	338	133	126	1,75	1,51	0,43
35	∅	white	7 × 2,52	1,30	9,80	1,40	12,60	445	164	154	1,29	1,11	0,49
35	217377	black	7 × 2,52	1,30	9,80	1,40	12,60	445	164	154	1,29	1,11	0,49
35	∅	g/y	7 × 2,52	1,30	9,80	1,40	12,60	445	164	154	1,29	1,11	0,49
50	∅	white	19 × 1,79	1,40	11,20	1,40	14,00	574	200	189	0,97	0,83	0,60
50	216441	black	19 × 1,79	1,40	11,20	1,40	14,00	574	200	189	0,97	0,83	0,60
50	∅	g/y	19 × 1,79	1,40	11,20	1,40	14,00	574	200	189	0,97	0,83	0,60
70	∅	white	19 × 2,15	1,60	13,30	1,45	16,20	803	255	241	0,69	0,60	0,72
70	302739	black	19 × 2,15	1,60	13,30	1,45	16,20	803	255	241	0,69	0,60	0,72
70	∅	g/y	19 × 2,15	1,60	13,30	1,45	16,20	803	255	241	0,69	0,60	0,72
95	∅	white	19 × 2,52	1,70	15,30	1,55	18,40	1'081	316	295	0,52	0,45	0,91
95	302740	black	19 × 2,52	1,70	15,30	1,55	18,40	1'081	316	295	0,52	0,45	0,91
95	∅	g/y	19 × 2,52	1,70	15,30	1,55	18,40	1'081	316	295	0,52	0,45	0,91

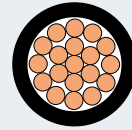
∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
120	∅	white	37 × 2,02	1,80	17,20	1,70	20,40	1'355	371	347	0,43	0,37	1,03
120	302741	black	37 × 2,02	1,80	17,20	1,70	20,40	1'355	371	347	0,43	0,37	1,03
120	∅	g/y	37 × 2,02	1,80	17,20	1,70	20,40	1'355	371	347	0,43	0,37	1,03
150	∅	white	37 × 2,23	1,90	19,00	1,70	22,40	1'652	426	399	0,36	0,31	1,23
150	302742	black	37 × 2,23	1,90	19,00	1,70	22,40	1'652	426	399	0,36	0,31	1,23
150	∅	g/y	37 × 2,23	1,90	19,00	1,70	22,40	1'652	426	399	0,36	0,31	1,23
185	∅	white	37 × 2,49	2,00	21,00	1,80	24,60	2'032	494	461	0,30	0,26	1,47
185	302743	black	37 × 2,49	2,00	21,00	1,80	24,60	2'032	494	461	0,30	0,26	1,47
185	∅	g/y	37 × 2,49	2,00	21,00	1,80	24,60	2'032	494	461	0,30	0,26	1,47
240	∅	white	61 × 2,23	2,20	23,80	1,90	27,60	2'643	589	550	0,25	0,21	1,79
240	302745	black	61 × 2,23	2,20	23,80	1,90	27,60	2'643	589	550	0,25	0,21	1,79
240	∅	g/y	61 × 2,23	2,20	23,80	1,90	27,60	2'643	589	550	0,25	0,21	1,79
300	∅	white	61 × 2,52	2,40	27,50	2,00	31,50	3'391	691	647	0,21	0,18	2,24
300	302746	black	61 × 2,52	2,40	27,50	2,00	31,50	3'391	691	647	0,21	0,18	2,24
300	∅	g/y	61 × 2,52	2,40	27,50	2,00	31,50	3'391	691	647	0,21	0,18	2,24
400	∅	white	61 × 2,85	2,60	30,90	2,10	35,10	4'285	805	756	0,18	0,16	2,55
400	302747	black	61 × 2,85	2,60	30,90	2,10	35,10	4'285	805	756	0,18	0,16	2,55
400	∅	g/y	61 × 2,85	2,60	30,90	2,10	35,10	4'285	805	756	0,18	0,16	2,55
500	∅	white	61 × 3,20	2,80	34,40	2,20	38,80	5'350	931	873	0,16	0,14	3,11
500	302748	black	61 × 3,20	2,80	34,40	2,20	38,80	5'350	931	873	0,16	0,14	3,11
500	∅	g/y	61 × 3,20	2,80	34,40	2,20	38,80	5'350	931	873	0,16	0,14	3,11
630	∅	white	127 × 2,52	3,00	38,80	2,40	43,60	6'855	1'076	1'005	0,14	0,12	3,84
630	302749	black	127 × 2,52	3,00	38,80	2,40	43,60	6'855	1'076	1'005	0,14	0,12	3,84
630	∅	g/y	127 × 2,52	3,00	38,80	2,40	43,60	6'855	1'076	1'005	0,14	0,12	3,84

∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 90 0,6 / 1 kV, acc. to BS 6387 C.W.Z., LSOH



Single Core / Single Insulated

Application

Single cores for use in cable wiring systems with improved fire performance and circuit integrity.

Use for: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to high risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Core identification:** Red, Black or Green-Yellow (other colours on request)

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 90 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 250 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 10 × outer Ø
Fixed installed > 6 × outer Ø
- **Laying conditions:** Use for electrical installations in control cabinets, switchboards, or other closed cable wiring systems.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / Ø ≤ 20 mm
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable Ø > 20 mm)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature 90 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving installation due to small outer diameter

Dimensions, Weight

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	301789	red	7 × 0,53	0,60	3,45	25	26	24	25,05	21,60	0,03
1,5	301790	black	7 × 0,53	0,60	3,45	25	26	24	25,05	21,60	0,03
1,5	301791	g/y	7 × 0,53	0,60	3,45	25	26	24	25,05	21,60	0,03
2,5	301792	red	7 × 0,68	0,68	4,00	37	35	33	15,47	13,30	0,04
2,5	301793	black	7 × 0,68	0,68	4,00	37	35	33	15,47	13,30	0,04
2,5	301794	g/y	7 × 0,68	0,68	4,00	37	35	33	15,47	13,30	0,04
4	301795	red	7 × 0,85	0,78	4,65	55	47	44	9,74	8,34	0,05
4	301796	black	7 × 0,85	0,78	4,65	55	47	44	9,74	8,34	0,05
4	301797	g/y	7 × 0,85	0,78	4,65	55	47	44	9,74	8,34	0,05
6	301798	red	7 × 1,04	0,83	5,15	75	61	57	6,61	5,63	0,06
6	301799	black	7 × 1,04	0,83	5,15	75	61	57	6,61	5,63	0,06
6	301800	g/y	7 × 1,04	0,83	5,15	75	61	57	6,61	5,63	0,06
10	301801	red	7 × 1,32	1,05	6,65	121	86	79	4,05	3,42	0,11
10	301802	black	7 × 1,32	1,05	6,65	121	86	79	4,05	3,42	0,11
10	301803	g/y	7 × 1,32	1,05	6,65	121	86	79	4,05	3,42	0,11
16	301805	red	7 × 1,72	1,05	7,50	181	115	105	2,66	2,21	0,12
16	301806	black	7 × 1,72	1,05	7,50	181	115	105	2,66	2,21	0,12
16	301807	g/y	7 × 1,72	1,05	7,50	181	115	105	2,66	2,21	0,12
25	301808	red	7 × 2,15	1,20	9,05	276	156	141	1,79	1,46	0,17
25	301809	black	7 × 2,15	1,20	9,05	276	156	141	1,79	1,46	0,17
25	301810	g/y	7 × 2,15	1,20	9,05	276	156	141	1,79	1,46	0,17
35	301811	red	7 × 2,52	1,20	10,20	369	194	174	1,37	1,10	0,19
35	301812	black	7 × 2,52	1,20	10,20	369	194	174	1,37	1,10	0,19
35	301813	g/y	7 × 2,52	1,20	10,20	369	194	174	1,37	1,10	0,19
50	301814	red	19 × 1,79	1,40	11,90	502	239	212	1,09	0,85	0,26
50	301815	black	19 × 1,79	1,40	11,90	502	239	212	1,09	0,85	0,26
50	301816	g/y	19 × 1,79	1,40	11,90	502	239	212	1,09	0,85	0,26
70	301817	red	19 × 2,15	1,40	13,60	699	304	273	0,84	0,64	0,31
70	301818	black	19 × 2,15	1,40	13,60	699	304	273	0,84	0,64	0,31
70	301819	g/y	19 × 2,15	1,40	13,60	699	304	273	0,84	0,64	0,31
95	301820	red	19 × 2,52	1,60	15,80	959	381	336	0,68	0,50	0,41
95	301821	black	19 × 2,52	1,60	15,80	959	381	336	0,68	0,50	0,41
95	∅	g/y	19 × 2,52	1,60	15,80	959	381	336	0,68	0,50	0,41

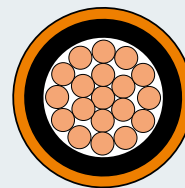
∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
120	301822	red	37 × 2,02	1,60	17,50	1'208	447	395	0,60	0,43	0,46
120	301823	black	37 × 2,02	1,60	17,50	1'208	447	395	0,60	0,43	0,46
120	∅	g/y	37 × 2,02	1,60	17,50	1'208	447	395	0,60	0,43	0,46
150	301824	red	37 × 2,23	1,80	19,50	1'483	517	452	0,54	0,38	0,57
150	301825	black	37 × 2,23	1,80	19,50	1'483	517	452	0,54	0,38	0,57
150	∅	g/y	37 × 2,23	1,80	19,50	1'483	517	452	0,54	0,38	0,57
185	301826	red	37 × 2,49	2,00	21,70	1'845	603	525	0,49	0,33	0,71
185	301827	black	37 × 2,49	2,00	21,70	1'845	603	525	0,49	0,33	0,71
185	∅	g/y	37 × 2,49	2,00	21,70	1'845	603	525	0,49	0,33	0,71
240	301828	red	61 × 2,23	2,20	24,50	2'418	724	627	0,44	0,29	0,88
240	301829	black	61 × 2,23	2,20	24,50	2'418	724	627	0,44	0,29	0,88
240	∅	g/y	61 × 2,23	2,20	24,50	2'418	724	627	0,44	0,29	0,88
300	301830	red	61 × 2,52	2,45	28,30	3'109	856	737	0,41	0,26	1,14
300	301831	black	61 × 2,52	2,45	28,30	3'109	856	737	0,41	0,26	1,14
300	∅	g/y	61 × 2,52	2,45	28,30	3'109	856	737	0,41	0,26	1,14
400	301832	red	61 × 2,85	2,65	31,70	3'948	1'007	862	0,38	0,24	1,38
400	301833	black	61 × 2,85	2,65	31,70	3'948	1'007	862	0,38	0,24	1,38
400	∅	g/y	61 × 2,85	2,65	31,70	3'948	1'007	862	0,38	0,24	1,38
500	301834	red	61 × 3,20	2,85	35,30	4'955	1'179	1'008	0,36	0,22	1,66
500	301835	black	61 × 3,20	2,85	35,30	4'955	1'179	1'008	0,36	0,22	1,66
500	∅	g/y	61 × 3,20	2,85	35,30	4'955	1'179	1'008	0,36	0,22	1,66
630	301836	red	127 × 2,52	3,05	39,70	6'384	1'385	1'184	0,34	0,21	2,01
630	301837	black	127 × 2,52	3,05	39,70	6'384	1'385	1'184	0,34	0,21	2,01
630	∅	g/y	127 × 2,52	3,05	39,70	6'384	1'385	1'184	0,34	0,21	2,01

∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 90 0,6 / 1 kV, acc. to BS 6387 C.W.Z., LSOH



Single Core / Double Insulated

Application

Power cable 0.6 / 1 kV for fixed installation in cable systems with improved fire performance and circuit integrity.

Use for: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to high risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Core identification:** White, Black or Green-Yellow (other colours on request)
- **Sheath:** BETAflam® mineral copolymer, Orange

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 90 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 250 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 10 × outer Ø
Fixed installed > 6 × outer Ø
- **Laying conditions:** For fixed installation indoor, in air, trays or dry tubes/ducts.
Outdoor laying only when protected from direct sunlight and other external impacts.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / Ø ≤ 20 mm
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable Ø > 20 mm)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature 90 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving installation due to small outer diameter

Dimensions, Weight

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	∅	white	7 × 0,53	0,60	3,45	0,95	5,35	46	26	24	24,90	21,52	0,11
1,5	301838	black	7 × 0,53	0,60	3,45	0,95	5,35	46	26	24	24,90	21,52	0,11
1,5	∅	g/y	7 × 0,53	0,60	3,45	0,95	5,35	46	26	24	24,90	21,52	0,11
2,5	∅	white	7 × 0,68	0,68	4,00	1,00	6,00	63	35	33	15,32	13,22	0,13
2,5	301839	black	7 × 0,68	0,68	4,00	1,00	6,00	63	35	33	15,32	13,22	0,13
2,5	∅	g/y	7 × 0,68	0,68	4,00	1,00	6,00	63	35	33	15,32	13,22	0,13
4	∅	white	7 × 0,85	0,78	4,65	1,05	6,75	78	47	44	9,55	8,27	0,16
4	301840	black	7 × 0,85	0,78	4,65	1,05	6,75	78	47	44	9,55	8,27	0,16
4	∅	g/y	7 × 0,85	0,78	4,65	1,05	6,75	78	47	44	9,55	8,27	0,16
6	∅	white	7 × 1,04	0,83	5,15	1,05	7,25	108	61	57	6,47	5,56	0,19
6	301841	black	7 × 1,04	0,83	5,15	1,05	7,25	108	61	57	6,47	5,56	0,19
6	∅	g/y	7 × 1,04	0,83	5,15	1,05	7,25	108	61	57	6,47	5,56	0,19
10	∅	white	7 × 1,32	1,05	6,65	1,40	9,45	177	86	79	3,92	3,35	0,31
10	301842	black	7 × 1,32	1,05	6,65	1,40	9,45	177	86	79	3,92	3,35	0,31
10	∅	g/y	7 × 1,32	1,05	6,65	1,40	9,45	177	86	79	3,92	3,35	0,31
16	∅	white	7 × 1,72	1,05	7,50	1,40	10,30	250	115	105	2,53	2,14	0,35
16	301843	black	7 × 1,72	1,05	7,50	1,40	10,30	250	115	105	2,53	2,14	0,35
16	∅	g/y	7 × 1,72	1,05	7,50	1,40	10,30	250	115	105	2,53	2,14	0,35
25	∅	white	7 × 2,15	1,20	9,05	1,40	11,85	355	156	141	1,66	1,39	0,43
25	301844	black	7 × 2,15	1,20	9,05	1,40	11,85	355	156	141	1,66	1,39	0,43
25	∅	g/y	7 × 2,15	1,20	9,05	1,40	11,85	355	156	141	1,66	1,39	0,43
35	∅	white	7 × 2,52	1,20	10,20	1,40	13,00	456	194	174	1,24	1,03	0,49
35	301845	black	7 × 2,52	1,20	10,20	1,40	13,00	456	194	174	1,24	1,03	0,49
35	∅	g/y	7 × 2,52	1,20	10,20	1,40	13,00	456	194	174	1,24	1,03	0,49
50	∅	white	19 × 1,79	1,40	11,90	1,40	14,70	600	239	212	0,96	0,78	0,60
50	301846	black	19 × 1,79	1,40	11,90	1,40	14,70	600	239	212	0,96	0,78	0,60
50	∅	g/y	19 × 1,79	1,40	11,90	1,40	14,70	600	239	212	0,96	0,78	0,60
70	∅	white	19 × 2,15	1,40	13,60	1,50	16,60	813	304	273	0,71	0,57	0,72
70	301847	black	19 × 2,15	1,40	13,60	1,50	16,60	813	304	273	0,71	0,57	0,72
70	∅	g/y	19 × 2,15	1,40	13,60	1,50	16,60	813	304	273	0,71	0,57	0,72
95	∅	white	19 × 2,52	1,60	15,80	1,60	19,00	1'101	381	336	0,55	0,43	0,91
95	301848	black	19 × 2,52	1,60	15,80	1,60	19,00	1'101	381	336	0,55	0,43	0,91
95	∅	g/y	19 × 2,52	1,60	15,80	1,60	19,00	1'101	381	336	0,55	0,43	0,91

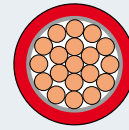
∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
120	∅	white	37 × 2,02	1,60	17,50	1,65	20,80	1'372	447	395	0,47	0,36	1,03
120	301849	black	37 × 2,02	1,60	17,50	1,65	20,80	1'372	447	395	0,47	0,36	1,03
120	∅	g/y	37 × 2,02	1,60	17,50	1,65	20,80	1'372	447	395	0,47	0,36	1,03
150	∅	white	37 × 2,23	1,80	19,50	1,70	22,90	1'645	517	452	0,41	0,31	1,23
150	301850	black	37 × 2,23	1,80	19,50	1,70	22,90	1'645	517	452	0,41	0,31	1,23
150	∅	g/y	37 × 2,23	1,80	19,50	1,70	22,90	1'645	517	452	0,41	0,31	1,23
185	∅	white	37 × 2,49	2,00	21,70	1,80	25,30	2'021	603	525	0,36	0,27	1,47
185	301851	black	37 × 2,49	2,00	21,70	1,80	25,30	2'021	603	525	0,36	0,27	1,47
185	∅	g/y	37 × 2,49	2,00	21,70	1,80	25,30	2'021	603	525	0,36	0,27	1,47
240	∅	white	61 × 2,23	2,20	24,50	1,90	28,30	2'598	724	627	0,31	0,22	1,81
240	301852	black	61 × 2,23	2,20	24,50	1,90	28,30	2'598	724	627	0,31	0,22	1,81
240	∅	g/y	61 × 2,23	2,20	24,50	1,90	28,30	2'598	724	627	0,31	0,22	1,81
300	∅	white	61 × 2,52	2,45	28,30	2,00	32,30	3'440	856	737	0,28	0,20	2,31
300	301853	black	61 × 2,52	2,45	28,30	2,00	32,30	3'440	856	737	0,28	0,20	2,31
300	∅	g/y	61 × 2,52	2,45	28,30	2,00	32,30	3'440	856	737	0,28	0,20	2,31
400	∅	white	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'007	862	0,25	0,17	2,65
400	301854	black	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'007	862	0,25	0,17	2,65
400	∅	g/y	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'007	862	0,25	0,17	2,65
500	∅	white	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'179	1'008	0,23	0,16	3,36
500	301855	black	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'179	1'008	0,23	0,16	3,36
500	∅	g/y	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'179	1'008	0,23	0,16	3,36
630	∅	white	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'385	1'184	0,21	0,14	4,06
630	301856	black	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'385	1'184	0,21	0,14	4,06
630	∅	g/y	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'385	1'184	0,21	0,14	4,06

∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 90 °C
² Free in air, spaced
³ Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 110 0,6 / 1 kV, acc. to BS 6387 C.W.Z., L50H



Single Core / Single Insulated

Application

Single cores for use in cable wiring systems with improved fire performance and circuit integrity.

For use: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to high risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Core identification:** Red, Black or Green-Yellow (other colours on request)

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 110 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 280 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 10 × outer Ø
Fixed installed > 6 × outer Ø
- **Laying conditions:** Use for electrical installations in control cabinets, switchboards, or other closed cable wiring systems.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / Ø ≤ 20 mm
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable Ø > 20 mm)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature 110 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving installation due to small outer diameter

Dimensions, Weight

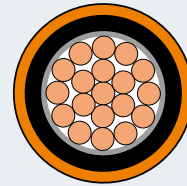
Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	218945	red	7 × 0,53	0,60	3,45	25	27	26	25,05	21,60	0,03
1,5	303590	brown	7 × 0,53	0,60	3,45	25	27	26	25,05	21,60	0,03
1,5	218946	black	7 × 0,53	0,60	3,45	25	27	26	25,05	21,60	0,03
1,5	303589	blue	7 × 0,53	0,60	3,45	25	27	26	25,05	21,60	0,03
1,5	301742	g/y	7 × 0,53	0,60	3,45	25	27	26	25,05	21,60	0,03
2,5	218947	red	7 × 0,68	0,68	4,00	37	38	36	15,47	13,30	0,04
2,5	303592	brown	7 × 0,68	0,68	4,00	37	38	36	15,47	13,30	0,04
2,5	218948	black	7 × 0,68	0,68	4,00	37	38	36	15,47	13,30	0,04
2,5	303591	blue	7 × 0,68	0,68	4,00	37	38	36	15,47	13,30	0,04
2,5	220893	g/y	7 × 0,68	0,68	4,00	37	38	36	15,47	13,30	0,04
4	215212	red	7 × 0,85	0,78	4,65	55	51	48	9,74	8,34	0,05
4	303593	brown	7 × 0,85	0,78	4,65	55	51	48	9,74	8,34	0,05
4	215544	black	7 × 0,85	0,78	4,65	55	51	48	9,74	8,34	0,05
4	215142	g/y	7 × 0,85	0,78	4,65	55	51	48	9,74	8,34	0,05
6	215889	red	7 × 1,04	0,83	5,15	75	65	62	6,61	5,63	0,06
6	215214	black	7 × 1,04	0,83	5,15	75	65	62	6,61	5,63	0,06
6	219233	g/y	7 × 1,04	0,83	5,15	75	65	62	6,61	5,63	0,06
10	215800	red	7 × 1,32	1,05	6,65	121	90	85	4,05	3,42	0,11
10	217300	black	7 × 1,32	1,05	6,65	121	90	85	4,05	3,42	0,11
10	220894	g/y	7 × 1,32	1,05	6,65	121	90	85	4,05	3,42	0,11
16	215801	red	7 × 1,72	1,05	7,50	181	121	114	2,66	2,21	0,12
16	301743	black	7 × 1,72	1,05	7,50	181	121	114	2,66	2,21	0,12
16	301744	g/y	7 × 1,72	1,05	7,50	181	121	114	2,66	2,21	0,12
25	216106	red	7 × 2,15	1,20	9,05	276	163	155	1,79	1,46	0,17
25	301745	black	7 × 2,15	1,20	9,05	276	163	155	1,79	1,46	0,17
25	301746	g/y	7 × 2,15	1,20	9,05	276	163	155	1,79	1,46	0,17
35	216758	red	7 × 2,52	1,20	10,20	369	202	190	1,37	1,10	0,19
35	301747	black	7 × 2,52	1,20	10,20	369	202	190	1,37	1,10	0,19
35	301748	g/y	7 × 2,52	1,20	10,20	369	202	190	1,37	1,10	0,19
50	216759	red	19 × 1,79	1,40	11,90	502	245	232	1,09	0,85	0,26
50	301749	black	19 × 1,79	1,40	11,90	502	245	232	1,09	0,85	0,26
50	301750	g/y	19 × 1,79	1,40	11,90	502	245	232	1,09	0,85	0,26
70	301751	red	19 × 2,15	1,40	13,60	699	315	295	0,84	0,64	0,31
70	301752	black	19 × 2,15	1,40	13,60	699	315	295	0,84	0,64	0,31
70	301753	g/y	19 × 2,15	1,40	13,60	699	315	295	0,84	0,64	0,31

Ø = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 110 °C
² Free in air, spaced
³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
							1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
95	216760	red	19 × 2,52	1,60	15,80	959	388	365	0,68	0,50	0,41
95	∅	black	19 × 2,52	1,60	15,80	959	388	365	0,68	0,50	0,41
95	301754	g/y	19 × 2,52	1,60	15,80	959	388	365	0,68	0,50	0,41
120	219394	red	37 × 2,02	1,60	17,50	1'208	455	434	0,60	0,43	0,46
120	∅	black	37 × 2,02	1,60	17,50	1'208	455	434	0,60	0,43	0,46
120	301755	g/y	37 × 2,02	1,60	17,50	1'208	455	434	0,60	0,43	0,46
150	219395	red	37 × 2,23	1,80	19,50	1'483	521	495	0,54	0,38	0,57
150	∅	black	37 × 2,23	1,80	19,50	1'483	521	495	0,54	0,38	0,57
150	301756	g/y	37 × 2,23	1,80	19,50	1'483	521	495	0,54	0,38	0,57
185	219396	red	37 × 2,49	2,00	21,70	1'845	606	572	0,49	0,33	0,71
185	∅	black	37 × 2,49	2,00	21,70	1'845	606	572	0,49	0,33	0,71
185	301760	g/y	37 × 2,49	2,00	21,70	1'845	606	572	0,49	0,33	0,71
240	219397	red	61 × 2,23	2,20	24,50	2'418	723	681	0,44	0,29	0,88
240	∅	black	61 × 2,23	2,20	24,50	2'418	723	681	0,44	0,29	0,88
240	301761	g/y	61 × 2,23	2,20	24,50	2'418	723	681	0,44	0,29	0,88
300	300945	red	61 × 2,52	2,45	28,30	3'109	852	804	0,41	0,26	1,14
300	∅	black	61 × 2,52	2,45	28,30	3'109	852	804	0,41	0,26	1,14
300	301762	g/y	61 × 2,52	2,45	28,30	3'109	852	804	0,41	0,26	1,14
400	301763	red	61 × 2,85	2,65	31,70	3'948	996	929	0,38	0,24	1,38
400	∅	black	61 × 2,85	2,65	31,70	3'948	996	929	0,38	0,24	1,38
400	v	g/y	61 × 2,85	2,65	31,70	3'948	996	929	0,38	0,24	1,38
500	301764	red	61 × 3,20	2,85	35,30	4'955	1'164	1'095	0,36	0,22	1,66
500	v	black	61 × 3,20	2,85	35,30	4'955	1'164	1'095	0,36	0,22	1,66
500	∅	g/y	61 × 3,20	2,85	35,30	4'955	1'164	1'095	0,36	0,22	1,66
630	301765	red	127 × 2,52	3,05	39,70	6'384	1'367	1'266	0,34	0,21	2,01
630	∅	black	127 × 2,52	3,05	39,70	6'384	1'367	1'266	0,34	0,21	2,01
630	v	g/y	127 × 2,52	3,05	39,70	6'384	1'367	1'266	0,34	0,21	2,01

∅ = On request g/y = Green/Yellow ¹ AC circuit, max. conductor temperature 110 °C
² Free in air, spaced
³ Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 110 0,6 / 1 kV, acc. to BS 6387 C.W.Z., L50H**Single Core / Double Insulated****Application**

Power cable 0.6 / 1 kV for fixed installation in cable systems with improved fire performance and circuit integrity.

Use for: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc.

Especially recommended in areas where human and animal life as well as valuable property are exposed to high risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Core identification:** White, Black or Green-Yellow (other colours on request)
- **Sheath:** BETAflam® mineral copolymer, Orange

Technical specification

- **Rated voltage:** U₀/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from – 30 °C to + 110 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 280 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 10 × outer Ø
Fixed installed > 6 × outer Ø
- **Laying conditions:** For fixed installation indoor, in air, trays ore dry tubes/ ducts. Outdoor laying only when protected from direct sunlight and other external impacts.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / Ø ≤ 20 mm
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable Ø > 20 mm)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature 110 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials
- Space saving installation due to small outer diameter

Dimensions, Weight

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	301766	white	7 × 0,53	0,60	3,45	0,95	5,35	46	32	30	24,90	21,52	0,11
1,5	215060	black	7 × 0,53	0,60	3,45	0,95	5,35	46	32	30	24,90	21,52	0,11
1,5	301767	g/y	7 × 0,53	0,60	3,45	0,95	5,35	46	32	30	24,90	21,52	0,11
2,5	301768	white	7 × 0,68	0,68	4,00	1,00	6,00	63	43	40	15,32	13,22	0,13
2,5	215038	black	7 × 0,68	0,68	4,00	1,00	6,00	63	43	40	15,32	13,22	0,13
2,5	301769	g/y	7 × 0,68	0,68	4,00	1,00	6,00	63	43	40	15,32	13,22	0,13
4	301770	white	7 × 0,85	0,78	4,65	1,05	6,75	78	57	52	9,55	8,27	0,16
4	215061	black	7 × 0,85	0,78	4,65	1,05	6,75	78	57	52	9,55	8,27	0,16
4	301771	g/y	7 × 0,85	0,78	4,65	1,05	6,75	78	57	52	9,55	8,27	0,16
6	301772	white	7 × 1,04	0,83	5,15	1,05	7,25	108	74	67	6,47	5,56	0,19
6	215062	black	7 × 1,04	0,83	5,15	1,05	7,25	108	74	67	6,47	5,56	0,19
6	301773	g/y	7 × 1,04	0,83	5,15	1,05	7,25	108	74	67	6,47	5,56	0,19
10	301774	white	7 × 1,32	1,05	6,65	1,40	9,45	177	104	94	3,92	3,35	0,31
10	215063	black	7 × 1,32	1,05	6,65	1,40	9,45	177	104	94	3,92	3,35	0,31
10	301775	g/y	7 × 1,32	1,05	6,65	1,40	9,45	177	104	94	3,92	3,35	0,31
16	301776	white	7 × 1,72	1,05	7,50	1,40	10,30	250	137	123	2,53	2,14	0,35
16	215064	black	7 × 1,72	1,05	7,50	1,40	10,30	250	137	123	2,53	2,14	0,35
16	301777	g/y	7 × 1,72	1,05	7,50	1,40	10,30	250	137	123	2,53	2,14	0,35
25	301778	white	7 × 2,15	1,20	9,05	1,40	11,85	355	183	163	1,66	1,39	0,43
25	214904	black	7 × 2,15	1,20	9,05	1,40	11,85	355	183	163	1,66	1,39	0,43
25	301779	g/y	7 × 2,15	1,20	9,05	1,40	11,85	355	183	163	1,66	1,39	0,43
35	301780	white	7 × 2,52	1,20	10,20	1,40	13,00	456	224	200	1,24	1,03	0,49
35	215065	black	7 × 2,52	1,20	10,20	1,40	13,00	456	224	200	1,24	1,03	0,49
35	∅	g/y	7 × 2,52	1,20	10,20	1,40	13,00	456	224	200	1,24	1,03	0,49
50	301781	white	19 × 1,79	1,40	11,90	1,40	14,70	600	274	242	0,96	0,78	0,60
50	214906	black	19 × 1,79	1,40	11,90	1,40	14,70	600	274	242	0,96	0,78	0,60
50	∅	g/y	19 × 1,79	1,40	11,90	1,40	14,70	600	274	242	0,96	0,78	0,60
70	301782	white	19 × 2,15	1,40	13,60	1,50	16,60	813	345	308	0,71	0,57	0,72
70	214908	black	19 × 2,15	1,40	13,60	1,50	16,60	813	345	308	0,71	0,57	0,72
70	∅	g/y	19 × 2,15	1,40	13,60	1,50	16,60	813	345	308	0,71	0,57	0,72

∅ = On request

g/y = Green/Yellow

¹ AC circuit, max. conductor temperature 110 °C

² Free in air, spaced

³ Open tray, touching

Cross section	Part no. LSA	Core colour	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ³	1 phase system	3 phase system	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
95	301783	white	19 × 2,52	1,60	15,80	1,60	19,00	1'101	428	379	0,55	0,43	0,91
95	214909	black	19 × 2,52	1,60	15,80	1,60	19,00	1'101	428	379	0,55	0,43	0,91
95	∅	g/y	19 × 2,52	1,60	15,80	1,60	19,00	1'101	428	379	0,55	0,43	0,91
120	301784	white	37 × 2,02	1,60	17,50	1,65	20,80	1'372	501	444	0,47	0,36	1,03
120	214911	black	37 × 2,02	1,60	17,50	1,65	20,80	1'372	501	444	0,47	0,36	1,03
120	∅	g/y	37 × 2,02	1,60	17,50	1,65	20,80	1'372	501	444	0,47	0,36	1,03
150	301785	white	37 × 2,23	1,80	19,50	1,70	22,90	1'645	577	509	0,41	0,31	1,23
150	214913	black	37 × 2,23	1,80	19,50	1,70	22,90	1'645	577	509	0,41	0,31	1,23
150	∅	g/y	37 × 2,23	1,80	19,50	1,70	22,90	1'645	577	509	0,41	0,31	1,23
185	301786	white	37 × 2,49	2,00	21,70	1,80	25,30	2'021	669	589	0,36	0,27	1,47
185	214915	black	37 × 2,49	2,00	21,70	1,80	25,30	2'021	669	589	0,36	0,27	1,47
185	∅	g/y	37 × 2,49	2,00	21,70	1,80	25,30	2'021	669	589	0,36	0,27	1,47
240	301787	white	61 × 2,23	2,20	24,50	1,90	28,30	2'598	800	700	0,31	0,22	1,81
240	214917	black	61 × 2,23	2,20	24,50	1,90	28,30	2'598	800	700	0,31	0,22	1,81
240	∅	g/y	61 × 2,23	2,20	24,50	1,90	28,30	2'598	800	700	0,31	0,22	1,81
300	301788	white	61 × 2,52	2,45	28,30	2,00	32,30	3'440	941	820	0,28	0,20	2,31
300	215043	black	61 × 2,52	2,45	28,30	2,00	32,30	3'440	941	820	0,28	0,20	2,31
300	∅	g/y	61 × 2,52	2,45	28,30	2,00	32,30	3'440	941	820	0,28	0,20	2,31
400	∅	white	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'104	961	0,25	0,17	2,65
400	215044	black	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'104	961	0,25	0,17	2,65
400	∅	g/y	61 × 2,85	2,65	31,70	2,15	36,00	4'394	1'104	961	0,25	0,17	2,65
500	∅	white	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'288	1'121	0,23	0,16	3,36
500	214898	black	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'288	1'121	0,23	0,16	3,36
500	∅	g/y	61 × 3,20	2,85	35,30	2,30	39,90	5'435	1'288	1'121	0,23	0,16	3,36
630	∅	white	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'526	1'311	0,21	0,14	4,06
630	214899	black	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'526	1'311	0,21	0,14	4,06
630	∅	g/y	127 × 2,52	3,05	39,70	2,40	44,50	6'965	1'526	1'311	0,21	0,14	4,06

∅ = On request

g/y = Green/Yellow

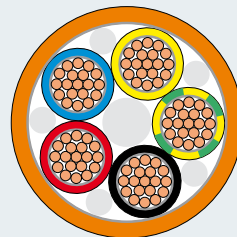
¹ AC circuit, max. conductor temperature 110 °C

² Free in air, spaced

³ Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 110 0,6 / 1 kV, acc. to BS 6387 C.W.Z., L50H



Multicore

Application

Multicore Power Cable 0.6 / 1 kV for fixed installation in cable systems with improved fire performance and circuit integrity. Use for: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Inner covering:** Glass fibre tape
- **Core identification:** See technical information
- **Sheath:** BETAflam® mineral copolymer, orange

Technical specification

- **Rated voltage:** U_0/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from -30 °C to $+110\text{ °C}$
Laying temperature from -5 °C to $+70\text{ °C}$
Short circuit temperature $+280\text{ °C}$ (temperature peak $\leq 5\text{ s}$)
- **Bending radius:**
During laying $> 12 \times \text{outer } \varnothing$
Fixed installed $> 7 \times \text{outer } \varnothing$
- **Laying conditions:** For fixed indoor installation in trays, ladders, ducts or concretes. Laying in earth or water only in water-proof dry tubes/ducts. Outdoor use only when protected from direct sunlight and other external impacts. Special designs with additional UV-, anti termite-, anti rodent- resistance are available on request.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / $\varnothing \leq 20\text{ mm}$
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable $\varnothing > 20\text{ mm}$)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature up to +110 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials

Dimensions, Weight

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	215091	2C	7 × 0,53	0,60	3,45	1,20	9,70	112	26		24,94		0,29
1,5	215448	2C+E	7 × 0,53	0,60	3,45	1,25	10,30	128	26		24,94		0,30
1,5	215344	3C	7 × 0,53	0,60	3,45	1,25	10,30	128		23		21,60	0,30
1,5	215923	3C+E	7 × 0,53	0,60	3,45	1,25	11,20	181		23		21,60	0,43
1,5	215066	4C	7 × 0,53	0,60	3,45	1,25	11,20	181		23		21,60	0,43
1,5	301858	4C+E	7 × 0,53	0,60	3,45	1,35	12,40	200					0,45
1,5	301859	5C	7 × 0,53	0,60	3,45	1,35	12,40	200					0,45
1,5	301860	7C	7 × 0,53	0,60	3,45	1,45	13,60	252					0,53
1,5	301861	10C	7 × 0,53	0,60	3,45	1,70	17,70	399					0,90
1,5	301862	14C	7 × 0,53	0,60	3,45	1,80	19,00	480					0,99
1,5	301863	19C	7 × 0,53	0,60	3,45	1,90	21,30	626					1,26
1,5	301864	21C	7 × 0,53	0,60	3,45	2,00	22,70	702					1,43
1,5	∅	24C	7 × 0,53	0,60	3,45	2,10	24,70	804					1,64
1,5	∅	33C	7 × 0,53	0,60	3,45	2,30	27,70	1059					2,10
1,5	∅	41C	7 × 0,53	0,60	3,45	2,60	32,40	1387					2,82
2,5	215093	2C	7 × 0,68	0,68	4,00	1,25	10,90	150	36		15,36		0,36
2,5	215811	2C+E	7 × 0,68	0,68	4,00	1,25	11,50	172	36		15,36		0,35
2,5	215067	3C	7 × 0,68	0,68	4,00	1,25	11,50	172		32		13,30	0,35
2,5	219259	3C+E	7 × 0,68	0,68	4,00	1,35	12,90	225		32		13,30	0,46
2,5	215068	4C	7 × 0,68	0,68	4,00	1,35	12,90	225		32		13,30	0,46
2,5	301865	4C+E	7 × 0,68	0,68	4,00	1,45	14,10	279					0,57
2,5	301866	5C	7 × 0,68	0,68	4,00	1,45	14,10	279					0,57
2,5	301867	7C	7 × 0,68	0,68	4,00	1,55	15,50	375					0,74
2,5	301868	10C	7 × 0,68	0,68	4,00	1,90	20,60	570					1,19
2,5	301869	12C	7 × 0,68	0,68	4,00	1,90	20,60	599					1,13
2,5	∅	16C	7 × 0,68	0,68	4,00	2,00	23,00	780					1,44
2,5	∅	21C	7 × 0,68	0,68	4,00	2,20	26,00	1003					1,82
2,5	∅	24C	7 × 0,68	0,68	4,00	2,30	28,40	1155					2,12
4	301871	2C	7 × 0,85	0,78	4,65	1,35	12,40	203	49		9,64		0,45
4	223867	2C+E	7 × 0,85	0,78	4,65	1,35	13,10	236	49		9,64		0,44
4	301872	3C	7 × 0,85	0,78	4,65	1,35	13,10	236		42		8,34	0,44
4	301873	3C+E	7 × 0,85	0,78	4,65	1,45	14,60	308		42		8,34	0,57
4	301874	4C	7 × 0,85	0,78	4,65	1,45	14,60	308		42		8,34	0,57
4	215932	4C+E	7 × 0,85	0,78	4,65	1,55	16,20	386					0,72
4	∅	5C	7 × 0,85	0,78	4,65	1,55	16,20	386					0,72
4	∅	7C	7 × 0,85	0,78	4,65	1,70	17,80	497					0,85
6	301875	2C	7 × 1,04	0,83	5,15	1,45	13,90	268	63		6,60		0,56
6	301876	2C+E	7 × 1,04	0,83	5,15	1,45	14,70	317	63		6,50		0,54
6	301877	3C	7 × 1,04	0,83	5,15	1,45	14,70	317		54		5,63	0,54
6	301878	3C+E	7 × 1,04	0,83	5,15	1,55	16,30	413		54		5,63	0,69
6	301240	4C	7 × 1,04	0,83	5,15	1,55	16,30	413		54		5,63	0,69
6	215545	4C+E	7 × 1,04	0,83	5,15	1,70	18,10	522					0,88

∅ = On request ¹ AC circuit, max. conductor temperature 90 °C
² Open tray, touching

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg/km	A	A	mV/Am	mV/Am	kWh/m
10	301879	2C	7 × 1,32	1,05	6,65	1,80	17,40	428	86		3,95		0,89
10	223869	2C+E	7 × 1,32	1,05	6,65	1,80	18,40	543	86		3,95		0,98
10	301880	3C	7 × 1,32	1,05	6,65	1,80	18,40	543		75		3,42	0,98
10	301881	3C+E	7 × 1,32	1,05	6,65	1,80	20,20	653		75		3,42	1,06
10	301242	4C	7 × 1,32	1,05	6,65	1,80	20,20	653		75		3,42	1,06
10	215933	4C+E	7 × 1,32	1,05	6,65	1,80	22,10	805					1,28
16	224540	2C+E	7 × 1,72	1,05	7,50	1,80	20,40	749	115		2,56		1,13
16	301882	3C	7 × 1,72	1,05	7,50	1,80	20,40	749		100		2,21	1,13
16	301883	3C+E	7 × 1,72	1,05	7,50	1,80	22,30	913		100		2,21	1,20
16	215546	4C	7 × 1,72	1,05	7,50	1,80	22,30	913		100		2,21	1,20
16	216433	4C+E	7 × 1,72	1,05	7,50	1,80	24,50	1134					1,48
25	223870	2C+E	7 × 2,15	1,20	9,05	1,80	23,60	1096	149		1,69		1,47
25	301884	3C	7 × 2,15	1,20	9,05	1,80	23,60	1096		127		1,46	1,47
25	301885	3C+E	7 × 2,15	1,20	9,05	1,80	26,20	1413		127		1,46	1,79
25	215547	4C	7 × 2,15	1,20	9,05	1,80	26,20	1413		127		1,46	1,79
25	301886	4C+E	7 × 2,15	1,20	9,05	1,90	29,00	1690					1,97
35	∅	2C+E	7 × 2,52	1,20	10,20	1,80	26,10	1408	185		1,26		1,66
35	301887	3C	7 × 2,52	1,20	10,20	1,80	26,10	1408		158		1,10	1,66
35	301888	3C+E	7 × 2,52	1,20	10,20	1,90	29,10	1839		158		1,10	2,09
35	215548	4C	7 × 2,52	1,20	10,20	1,90	29,10	1839		158		1,10	2,09
35	301889	4C+E	7 × 2,52	1,20	10,20	2,10	32,70	2321					2,70
50	∅	2C+E	19 × 1,79	1,40	11,90	1,90	29,90	1880	225		0,99		2,15
50	301890	3C	19 × 1,79	1,40	11,90	1,90	29,90	1880		192		0,85	2,15
50	301891	3C+E	19 × 1,79	1,40	11,90	2,10	33,50	2469		192		0,85	2,75
50	215549	4C	19 × 1,79	1,40	11,90	2,10	33,50	2469		192		0,85	2,75
50	301892	4C+E	19 × 1,79	1,40	11,90	2,20	37,70	3108					3,52
70	∅	2C+E	19 × 2,15	1,40	13,60	2,10	34,00	2603	289		0,74		2,73
70	301893	3C	19 × 2,15	1,40	13,60	2,10	34,00	2603		246		0,64	2,73
70	301894	3C+E	19 × 2,15	1,40	13,60	2,20	37,90	3383		246		0,64	3,33
70	301243	4C	19 × 2,15	1,40	13,60	2,20	37,90	3383		246		0,64	3,33
70	301895	4C+E	19 × 2,15	1,40	13,60	2,40	42,50	4263					4,29
95	∅	2C+E	19 × 2,52	1,60	15,80	2,30	39,30	3531	352		0,58		3,53
95	301896	3C	19 × 2,52	1,60	15,80	2,30	39,30	3531		298		0,50	3,53
95	301897	3C+E	19 × 2,52	1,60	15,80	2,40	43,10	4590		298		0,50	4,30
95	301244	4C	19 × 2,52	1,60	15,80	2,40	43,10	4590		298		0,50	4,30
95	301898	4C+E	19 × 2,52	1,60	15,80	2,50	48,30	5749					5,42
120	∅	2C+E	37 × 2,02	1,60	17,50	2,30	40,10	4327	410		0,49		3,82
120	301899	3C	37 × 2,02	1,60	17,50	2,30	40,10	4327		346		0,43	3,82
120	301900	3C+E	37 × 2,02	1,60	17,50	2,60	48,20	5773		346		0,43	5,12
120	219090	4C	37 × 2,02	1,60	17,50	2,60	48,20	5773		346		0,43	5,12
150	∅	2C+E	37 × 2,23	1,80	19,50	2,50	47,60	5359	473		0,44		4,86
150	301901	3C	37 × 2,23	1,80	19,50	2,50	47,60	5359		399		0,38	4,86
150	301902	3C+E	37 × 2,23	1,80	19,50	2,70	53,10	7063		399		0,38	6,21
185	∅	2C+E	37 × 2,49	2,00	21,70	2,70	52,70	6643	542		0,39		5,93
185	301903	3C	37 × 2,49	2,00	21,70	2,70	52,70	6643		456		0,33	5,93
185	301904	3C+E	37 × 2,49	2,00	21,70	2,90	58,70	8766		456		0,33	7,60

∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
240	∅	2C+E	61 × 2,23	2,20	24,50	2,90	59,10	8549	641				7,25
240	301905	3C	61 × 2,23	2,20	24,50	2,90	59,10	8549		538			7,25
240	∅	3C+E	61 × 2,23	2,20	24,50	3,10	65,90	11298		538			9,33
300	∅	2C+E	61 × 2,52	2,45	28,30	3,70	68,90	11283					10,08
300	301906	3C	61 × 2,52	2,45	28,30	3,70	68,90	11283					10,08
300	∅	3C+E	61 × 2,52	2,45	28,30	4,10	77,30	14866					12,83
400	∅	2C+E	61 × 2,85	2,65	31,70	4,10	77,10	14210					12,16
400	301907	3C	61 × 2,85	2,65	31,70	4,10	77,10	14210					12,16
400	∅	3C+E	61 × 2,85	2,65	31,70	4,30	85,80	18624					15,08

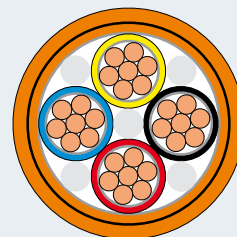
∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 110 0,6 / 1 kV, acc. to BS 6387 C.W.Z., L50H



Multicore / Steel Tape Armour (STA)

Application

Armoured Power Cable 0.6 / 1 kV with improved fire performance and circuit integrity. Suitable for fixed installation in areas with increased demand to mechanical stress. Typical applications: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Inner covering:** Glass fibre tape
- **Inner sheath:** BETAflam® mineral copolymer
- **Armouring:** Steel tape armour (STA)
- **Core identification:** See technical information
- **Sheath:** BETAflam® mineral copolymer, orange

Technical specification

- **Rated voltage:** U_0/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from -30 °C to $+110\text{ °C}$
Laying temperature from -5 °C to $+70\text{ °C}$
Short circuit temperature $+280\text{ °C}$ (temperature peak $\leq 5\text{ s}$)
- **Bending radius:**
During laying $> 15 \times \text{outer } \varnothing$
Fixed installed $> 9 \times \text{outer } \varnothing$
- **Laying conditions:** For fixed indoor installation in trays, ladders, ducts or concretes. Direct laying in earth or water only in water-proof dry tubes/ducts. Outdoor use if protected from direct sunlight only. Special designs with additional UV or anti termite-resistance are available on request.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / $\varnothing \leq 20\text{ mm}$
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable $\varnothing > 20\text{ mm}$)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature up to +110 °C
- In compliance with RoHS directive
- Robust cable with increased resistance to mechanical impact

Dimensions, Weight

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal diameter under STA	Nominal diameter over STA	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	Ø mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
1,5	301924	2C	7 × 0,53	9,7	10,5	1,8	14,1	390	26		24,94		0,68
1,5	301925	2C+E	7 × 0,53	10,3	11,1	1,8	14,7	419	26		24,94		0,71
1,5	301926	3C	7 × 0,53	10,3	11,1	1,8	14,7	419		23		21,60	0,71
1,5	301927	3C+E	7 × 0,53	11,2	12,0	1,8	15,6	525		23		21,60	0,88
1,5	301928	4C	7 × 0,53	11,2	12,0	1,8	15,6	525		23		21,60	0,88
1,5	301929	4C+E	7 × 0,53	12,4	13,2	1,8	16,8	568					0,93
1,5	301930	6C+E	7 × 0,53	13,6	14,4	1,8	18,0	665					1,05
1,5	301931	9C+E	7 × 0,53	17,7	18,5	1,8	22,1	985					1,56
1,5	∅	13C+E	7 × 0,53	19,0	19,8	1,8	23,4	1112					1,68
1,5	∅	18C+E	7 × 0,53	21,3	22,1	1,8	25,7	1373					2,03
1,5	∅	20C+E	7 × 0,53	22,7	23,5	1,8	27,1	1521					2,24
1,5	∅	23C+E	7 × 0,53	24,7	25,5	1,8	29,1	1715					2,52
1,5	∅	32C+E	7 × 0,53	27,7	28,5	1,8	32,1	2148					3,07
1,5	∅	40C+E	7 × 0,53	32,4	33,2	1,8	36,8	2770					3,95
2,5	301932	2C	7 × 0,68	10,9	11,7	1,8	15,3	468	36		15,36		0,79
2,5	301933	2C+E	7 × 0,68	11,5	12,3	1,8	15,9	498	36		15,36		0,81
2,5	301934	3C	7 × 0,68	11,5	12,3	1,8	15,9	498		32		13,30	0,81
2,5	301935	3C+E	7 × 0,68	12,9	13,7	1,8	17,3	604		32		13,30	0,96
2,5	301936	4C	7 × 0,68	12,9	13,7	1,8	17,3	604		32		13,30	0,96
2,5	301937	4C+E	7 × 0,68	14,1	14,9	1,8	18,5	710					1,10
2,5	∅	6C+E	7 × 0,68	15,5	16,3	1,8	19,9	879					1,33
2,5	∅	9C+E	7 × 0,68	20,6	21,4	1,8	25,0	1286					1,94
2,5	∅	15C+E	7 × 0,68	23,0	23,8	1,8	27,4	1606					2,26
2,5	∅	20C+E	7 × 0,68	26,0	26,8	1,8	30,4	1987					2,74
4	301938	2C	7 × 0,85	12,4	13,2	1,8	16,8	573	49		9,64		0,94
4	301939	2C+E	7 × 0,85	13,1	13,9	1,8	17,5	614	49		9,64		0,94
4	301940	3C	7 × 0,85	13,1	13,9	1,8	17,5	614		42		8,34	0,94
4	301941	3C+E	7 × 0,85	14,6	15,4	1,8	19,0	747		42		8,34	1,12
4	301942	4C	7 × 0,85	14,6	15,4	1,8	19,0	747		42		8,34	1,12
4	∅	4C+E	7 × 0,85	16,2	17,0	1,8	20,6	895					1,32
4	∅	6C+E	7 × 0,85	17,8	18,6	1,8	22,2	1070					1,51
6	∅	2C	7 × 1,04	13,9	14,7	1,8	18,3	692	63		6,60		1,09
6	∅	2C+E	7 × 1,04	14,7	15,5	1,8	19,1	749	63		6,60		1,09
6	301944	3C	7 × 1,04	14,7	15,5	1,8	19,1	749		54		5,63	1,09
6	301945	3C+E	7 × 1,04	16,3	17,1	1,8	20,7	915		54		5,63	1,29
6	301946	4C	7 × 1,04	16,3	17,1	1,8	20,7	915		54		5,63	1,29
6	∅	4C+E	7 × 1,04	18,1	18,9	1,8	22,5	1108					1,55

∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal diameter under STA	Nominal diameter over STA	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	Ø mm	Ø mm	mm	Ø mm	kg/km	A	A	mV/Am	mV/Am	kWh/m
10	∅	2C	7 × 1,32	17,4	18,2	1,8	21,8	1004	86		3,95		1,53
10	∅	2C+E	7 × 1,32	18,4	19,2	1,8	22,8	1162	86		3,95		1,65
10	301947	3C	7 × 1,32	18,4	19,2	1,8	22,8	1162		75		3,42	1,65
10	301948	3C+E	7 × 1,32	20,2	21,0	1,8	24,6	1324		75		3,42	1,79
10	301949	4C	7 × 1,32	20,2	21,0	1,8	24,6	1324		75		3,42	1,79
10	301950	4C+E	7 × 1,32	22,1	22,9	1,8	26,5	1572					2,08
16	∅	2C+E	7 × 1,72	20,4	21,2	1,8	24,8	1444	115		2,56		1,87
16	301951	3C+E	7 × 1,72	22,3	23,1	1,8	26,7	1660		100		2,21	2,00
16	301952	4C	7 × 1,72	22,3	23,1	1,8	26,7	1660		100		2,21	2,00
16	∅	4C+E	7 × 1,72	24,5	25,3	1,8	28,9	1996					2,35
25	∅	2C+E	7 × 2,15	23,6	24,4	1,8	28,0	1940	149		1,69		2,31
25	301953	3C+E	7 × 2,15	26,2	27,0	1,8	30,6	2392		127		1,46	2,72
25	301954	4C	7 × 2,15	26,2	27,0	1,8	30,6	2392		127		1,46	2,72
25	∅	4C+E	7 × 2,15	29,0	29,8	1,8	33,4	2768					2,99
35	∅	2C+E	7 × 2,52	26,1	26,9	1,8	30,5	2349	185		1,26		2,59
35	301955	3C+E	7 × 2,52	29,1	29,9	1,8	33,5	2948		158		1,10	3,11
35	301956	4C	7 × 2,52	29,1	29,9	1,8	33,5	2948		158		1,10	3,11
35	∅	4C+E	7 × 2,52	32,7	33,5	1,8	37,1	3663					3,83
50	∅	2C+E	19 × 1,79	29,9	30,7	1,8	34,3	3022	225		0,99		3,20
50	301957	3C+E	19 × 1,79	33,5	34,3	1,8	37,9	3838		198		0,85	3,91
50	301958	4C	19 × 1,79	33,5	34,3	1,8	37,9	3838		198		0,85	3,91
50	∅	4C+E	19 × 1,79	37,7	38,5	1,8	42,1	4764					4,82
70	∅	2C+E	19 × 2,15	34,0	34,8	1,8	38,4	3975	284		0,74		3,90
70	301959	3C+E	19 × 2,15	37,9	38,7	1,8	42,3	4990		246		0,64	4,63
70	301960	4C	19 × 2,15	37,9	38,7	1,8	42,3	4990		246		0,64	4,63
70	∅	4C+E	19 × 2,15	42,5	43,3	2,1	47,5	6286					6,00
95	∅	2C+E	19 × 2,52	39,3	40,1	2,1	44,3	5284	352		0,58		5,12
95	301961	3C+E	19 × 2,52	43,1	43,9	2,1	48,1	6625		298		0,50	6,02
95	301962	4C	19 × 2,52	43,1	43,9	2,1	48,1	6625		298		0,50	6,02
95	∅	4C+E	19 × 2,52	48,3	49,1	2,1	53,3	8195					7,35
120	∅	2C+E	37 × 2,02	40,1	40,9	2,1	45,1	6174	410		0,49		5,43
120	301963	3C+E	37 × 2,02	48,2	49,0	2,1	53,2	8132		346		0,43	7,04
120	301964	4C	37 × 2,02	48,2	49,0	2,1	53,2	8132		346		0,43	7,04
150	∅	2C+E	37 × 2,23	47,6	48,4	2,1	52,6	7636	473		0,44		6,76
150	301965	3C+E	37 × 2,23	53,1	53,9	2,5	58,9	9932		399		0,38	8,73
150	301966	4C	37 × 2,23	53,1	53,9	2,5	58,9	9932		399		0,38	8,73
185	∅	2C+E	37 × 2,49	52,7	53,5	2,5	58,5	9427	542		0,39		8,44
185	301967	3C+E	37 × 2,49	58,7	59,5	2,5	64,5	12138		456		0,33	10,37
185	301968	4C	37 × 2,49	58,7	59,5	2,5	64,5	12138		456		0,33	10,37
240	∅	2C+E	61 × 2,23	59,1	59,9	2,5	64,9	11831	641		0,34		10,04
240	301969	3C+E	61 × 2,23	65,9	66,7	2,9	72,5	15441		538		0,28	12,93
240	301970	4C	61 × 2,23	65,9	66,7	2,9	72,5	15441		538		0,28	12,93

∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

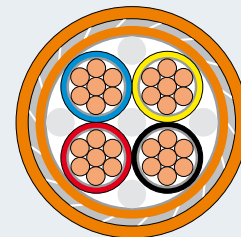
Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal diameter under STA	Nominal diameter over STA	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	Ø mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
300	∅	2C+E	61 × 2,52	68,9	69,7	2,9	75,5	15704					13,85
300	301971	3C+E	61 × 2,52	77,3	78,1	3,3	84,7	20407					17,63
300	301972	4C	61 × 2,52	77,3	78,1	3,3	84,7	20407					17,63
400	∅	2C+E	61 × 2,85	77,1	77,9	3,3	84,5	19561					16,95
400	∅	3C+E	61 × 2,85	85,8	86,6	3,7	94,0	25186					21,05
400	∅	4C	61 × 2,85	85,8	86,6	3,7	94,0	25186					21,05

∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

BETAflam® Fire Resistant Safety Cables

FR-MI 110 0,6 / 1 kV, acc. to BS 6387 C.W.Z., L50H**Multicore / Steel Wire Armour (SWA)****Application**

Armoured Power Cable 0.6 / 1 kV with improved fire performance and circuit integrity. Suitable for fixed installation in areas with increased demand to mechanical stress. Typical applications: Fire Alarm circuits, Fire Detection circuits, Emergency signal / Control circuits, Fire fighting systems (water pumps), Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to risk in case of fire.

Construction

- **Conductor:** Bare annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross-linked
- **Inner covering:** Glass fibre tape
- **Inner sheath:** BETAflam® mineral copolymer
- **Armouring:** Steel wire armour (SWA)
- **Core identification:** See technical information
- **Sheath:** BETAflam® mineral copolymer, orange

Technical specification

- **Rated voltage:** U_0/U 0,6 / 1 kV
- **Test voltage:** 4 kV / 50 Hz
- **Temperature range:**
Operation temperature from -30 °C to $+110\text{ °C}$
Laying temperature from -5 °C to $+70\text{ °C}$
Short circuit temperature $+280\text{ °C}$ (temperature peak $\leq 5\text{ s}$)
- **Bending radius:**
During laying $> 15 \times \text{outer } \varnothing$
Fixed installed $> 9 \times \text{outer } \varnothing$
- **Laying conditions:** For fixed indoor installation in trays, ladders, ducts or concretes. Direct laying in earth or water only in water-proof dry tubes/ducts. Outdoor use if protected from direct sunlight only. Special designs with additional UV or anti termite-resistance are available on request.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / $\varnothing \leq 20\text{ mm}$
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable $\varnothing > 20\text{ mm}$)

Advantages

- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature up to + 110 °C
- In compliance with RoHS directive
- Robust cable with increased resistance to mechanical impact

Dimensions, Weight

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal diameter under SWA	Nominal diameter over SWA	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	Ø mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
2,5	224529	2C+E	7 × 0,68	11,5	15,3	1,8	18,9	929	36		15,36		0,81
2,5	∅	3C	7 × 0,68	11,5	15,3	1,8	18,9	929		32		13,30	0,81
2,5	301914	3C+E	7 × 0,68	12,9	16,7	1,8	20,3	1070		32		13,30	0,96
2,5	301915	4C	7 × 0,68	12,9	16,7	1,8	20,3	1070		32		13,30	0,96
2,5	∅	4C+E	7 × 0,68	14,1	17,9	1,8	21,5	1205					1,10
4	224530	2C+E	7 × 0,85	13,1	16,9	1,8	20,5	1084	49		9,64		0,94
4	303204	3C	7 × 0,85	13,1	16,9	1,8	20,5	1084		42		8,34	0,94
4	301916	3C+E	7 × 0,85	14,6	16,6	1,8	20,2	953		42		8,34	1,12
4	224536	4C	7 × 0,85	14,6	16,6	1,8	20,2	953		42		8,34	1,12
4	∅	4C+E	7 × 0,85	16,2	18,2	1,8	21,8	1085					1,32
6	224531	2C+E	7 × 1,04	14,7	16,7	1,8	20,3	956	63		6,60		1,09
6	∅	3C	7 × 1,04	14,7	16,7	1,8	20,3	956		54		5,63	1,09
6	301917	3C+E	7 × 1,04	16,3	18,3	1,8	21,9	1106		54		5,63	1,29
6	301918	4C	7 × 1,04	16,3	18,3	1,8	21,9	1106		54		5,63	1,29
6	∅	4C+E	7 × 1,04	18,1	20,1	1,8	23,7	1315					1,55
10	301919	2C+E	7 × 1,32	18,4	20,4	1,8	24,0	1372	86		3,95		1,65
10	303203	3C	7 × 1,32	18,4	20,4	1,8	24,0	1372		75		3,42	1,65
10	∅	3C+E	7 × 1,32	20,2	22,2	1,8	25,8	1552		75		3,42	1,79
10	224537	4C	7 × 1,32	20,2	22,2	1,8	25,8	1552		75		3,42	1,79
10	∅	4C+E	7 × 1,32	22,1	24,1	1,8	27,7	1817					2,08
16	224532	2C+E	7 × 1,72	20,4	22,4	1,8	26,0	1673	115		2,56		1,87
16	∅	3C+E	7 × 1,72	22,3	24,3	1,8	27,9	1907		100		2,21	2,00
16	224538	4C	7 × 1,72	22,3	24,3	1,8	27,9	1907		100		2,21	2,00
16	∅	4C+E	7 × 1,72	24,5	26,5	1,8	30,1	2264					2,35
25	224533	2C+E	7 × 2,15	23,6	25,6	1,8	29,2	2200	149		1,69		2,31
25	303202	3C	7 × 2,15	26,2	29,0	1,8	32,6	2976		127		1,46	2,72
25	∅	3C+E	7 × 2,15	26,2	29,0	1,8	32,6	2976		127		1,46	2,72
25	224539	4C	7 × 2,15	26,2	29,0	1,8	32,6	2976		127		1,46	2,72
25	∅	4C+E	7 × 2,15	29,0	31,8	1,8	35,4	3405					2,99
35	301920	2C+E	7 × 2,52	26,1	28,9	1,8	32,5	2931	185		1,26		2,59
35	∅	3C+E	7 × 2,52	29,1	31,9	1,8	35,5	3588		158		1,10	3,11
35	223874	4C	7 × 2,52	29,1	31,9	1,8	35,5	3588		158		1,10	3,11
35	∅	4C+E	7 × 2,52	32,7	35,5	1,8	39,1	4370					3,83
50	223871	2C+E	19 × 1,79	29,9	32,7	1,8	36,3	3677	225		0,99		3,20
50	∅	3C+E	19 × 1,79	33,5	36,3	1,8	39,9	4561		198		0,85	3,91
50	223875	4C	19 × 1,79	33,5	36,3	1,8	39,9	4561		198		0,85	3,91

∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

Cross section	Part no. LSA	Number of cores	Conductor stranding	Nominal diameter under SWA	Nominal diameter over SWA	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Current Rating ¹		AC Voltage Drop		Fire Load
									1 phase ²	3 phase ²	1 phase ²	3 phase ²	
mm ²			n × Ø mm	Ø mm	Ø mm	mm	Ø mm	kg / km	A	A	mV / Am	mV / Am	kWh / m
70	223872	2C+E	19 × 2,15	34,0	36,8	1,8	40,4	4708	284		0,74		3,90
70	223873	3C	19 × 2,15	34,0	36,8	1,8	40,4	4708	284		0,74		3,90
70	∅	3C+E	19 × 2,15	37,9	40,7	2,1	44,9	5863		246		0,64	4,63
70	301921	4C	19 × 2,15	37,9	40,7	2,1	44,9	5863		246		0,64	4,63
95	224535	2C+E	19 × 2,52	39,3	42,1	2,1	46,3	6120	352		0,58		5,12
95	301922	3C+E	19 × 2,52	43,1	45,9	2,1	50,1	7534		298		0,50	6,02
95	223876	4C	19 × 2,52	43,1	45,9	2,1	50,1	7534		298		0,50	6,02
120	∅	2C+E	37 × 2,02	40,1	42,9	2,1	47,1	7025	410		0,49		5,43
120	∅	3C+E	37 × 2,02	48,2	51,0	2,5	56,0	9248		346		0,43	7,04
120	301923	4C	37 × 2,02	48,2	51,0	2,5	56,0	9248		346		0,43	7,04
150	∅	2C+E	37 × 2,23	47,6	50,4	2,5	55,4	8739	473		0,44		6,76
150	∅	3C+E	37 × 2,23	53,1	55,9	2,5	60,9	11035		399		0,38	8,73
150	223877	4C	37 × 2,23	53,1	55,9	2,5	60,9	11035		399		0,38	8,73
185	∅	2C+E	37 × 2,49	52,7	55,5	2,5	60,5	10522	542		0,39		8,44
185	∅	3C+E	37 × 2,49	58,7	61,5	2,9	67,3	13480		456		0,33	10,37
185	223878	4C	37 × 2,49	58,7	61,5	2,9	67,3	13480		456		0,33	10,37
240	∅	2C+E	61 × 2,23	59,1	61,9	2,9	67,7	13182	641		0,34		10,04
240	∅	3C+E	61 × 2,23	65,9	68,7	2,9	74,5	16791		538		0,28	12,93
240	223879	4C	61 × 2,23	65,9	68,7	2,9	74,5	16791		538		0,28	12,93
300	∅	2C+E	61 × 2,52	68,9	71,7	3,3	78,3	17266					13,85
300	∅	3C+E	61 × 2,52	77,3	80,1	3,7	87,5	22151					17,63
300	223880	4C	61 × 2,52	77,3	80,1	3,7	87,5	22151					17,63
400	∅	2C+E	61 × 2,85	77,1	79,9	3,3	86,5	21128					16,95
400	∅	3C+E	61 × 2,85	85,8	88,6	3,7	96,0	26923					21,05
400	223881	4C	61 × 2,85	85,8	88,6	3,7	96,0	26923					21,05

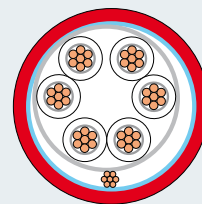
∅ = On request

¹ AC circuit, max. conductor temperature 90 °C

² Open tray, touching

BETAflam® Fire Resistant Comms Cables screened**FR-MI 110**

300 / 500 V, acc. to BS 6387 C.W.Z.

**Comms Cables – Shielded/Unshielded Twisted Pair (S/UTP)****Application**

Shielded communication cable 300 / 600 V for fixed installation in cable systems with excellent fire performance and circuit integrity. For Fire Alarm Circuits, Fire Detection Circuits, Emergency Signal / Control Circuits, Fire Fighting Systems (water pumps) and Smoke Exhaust Systems etc. Especially recommended in areas where human and animal life as well as valuable property are exposed to risk in case of fire.

Construction

- **Conductors:** Tinned annealed copper, acc. IEC 60228 class 2
- **Flame barrier:** MICA tape
- **Insulation:** BETAflam® mineral copolymer, cross linked
- **Inner covering:** Glass fibre tape
- **Screening:** Aluminium laminated foil with drain wire
- **Sheath:** BETAflam® mineral copolymer
- **Core identification:** White cores with black number marking (other colours on request)
- **Sheath colour:** Red or Orange (other colours on request)

Technical specification

- **Rated voltage:** U₀/U 300 / 500 V
- **Test voltage:** 0.5 / 2 kV / 50 Hz (core-screen / core-core)
- **Temperature range:**
Operation temperature from – 30 °C to + 110 °C
Laying temperature from – 5 °C to + 70 °C
Short circuit temperature + 250 °C (temperature peak ≤ 5 s)
- **Bending radius:**
During laying > 12 × outer Ø
Fixed installed > 8 × outer Ø
- **Laying conditions:** For fixed indoor installation in trays, ladders, ducts or concretes. Laying in earth or water only in water-proof dry tubes/ducts. Outdoor use only when protected from direct sunlight and other external impacts.

Material properties

- **Halogen free:** IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1
- **No corrosive gases:** IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2
- **No toxic gases:** NES 02-713; NF C20-454; BS EN 50267-2-1
- **Low smoke density:** IEC 61034-1 & -2; BS EN 61034-2; VDE 0482-1034-1 & -2

Fire performance

- **Flame retardant:** IEC 60332-1; BS EN 60332-1; VDE 0482-332-1
- **No flame propagation:** IEC 60332-3-24; EN 60332-3-24; VDE 0482-266-1 & -2-4
- **Insulation integrity FE180:** IEC 60331-21; VDE 0472-814
- **Circuit integrity:**
BS 6387 C.W.Z. / Ø ≤ 20 mm
BS 7846 Category F2 (Amendment 1 & 2, Annex L.1 / cable Ø > 20 mm)

Advantages


- High safety standard: BS 6387 C.W.Z, fully tested by LPCB / UKAS
- Halogen and silicone free
- Operating temperature up to + 110 °C
- In compliance with RoHS directive
- Mineral filled fire resistant materials

Dimensions, Weight

Cross section	Part no. LSA	Sheath colour	Number of pairs	Conductor stranding	Nominal thickness insulation	Nominal diameter core	Nominal thickness sheath	Nominal diameter cable	Approx. weight	Fire Load
mm ²				n × Ø mm	mm	Ø mm	mm	Ø mm	kg / km	kWh / m
0,75	301973	orange	1P	7 × 0,37	0,60	3,05	1,15	8,70	52	0,21
0,75	301974	orange	2P	7 × 0,37	0,60	3,05	1,25	10,20	77	0,31
0,75	301975	orange	3P	7 × 0,37	0,60	3,05	1,55	15,20	126	0,54
0,75	301976	orange	5P	7 × 0,37	0,60	3,05	1,80	18,60	201	0,88
0,75	301977	orange	7P	7 × 0,37	0,60	3,05	1,90	20,30	236	0,99
0,75	301978	orange	10P	7 × 0,37	0,60	3,05	2,20	26,20	343	1,47
1	225323	red	1P	7 × 0,43	0,65	3,30	1,20	9,30	59	0,24
1	301979	orange	2P	7 × 0,43	0,65	3,30	1,25	10,80	86	0,34
1	∅	orange	3P	7 × 0,43	0,65	3,30	1,55	16,20	142	0,59
1	301980	orange	5P	7 × 0,43	0,65	3,30	1,80	20,00	229	0,98
1	∅	orange	7P	7 × 0,43	0,65	3,30	2,00	22,10	278	1,15
1	301981	orange	10P	7 × 0,43	0,65	3,30	2,30	28,50	403	1,69
1,5	215389	red	1P	7 × 0,53	0,65	3,60	1,25	10,00	69	0,26
1,5	218481	orange	2P	7 × 0,53	0,65	3,60	1,25	11,20	100	0,36
1,5	303775	orange	3P	7 × 0,53	0,65	3,60	1,70	17,70	175	0,69
1,5	301982	orange	5P	7 × 0,53	0,65	3,60	1,90	21,70	277	1,11
1,5	301983	orange	7P	7 × 0,53	0,65	3,60	2,10	23,90	339	1,3
1,5	301984	orange	10P	7 × 0,53	0,65	3,60	2,40	30,80	490	1,9
2,5	221865	red	1P	7 × 0,68	0,70	4,10	1,25	11,00	85	0,3
2,5	303776	orange	2P	7 × 0,68	0,70	4,10	1,35	12,90	135	0,45
2,5	301985	orange	3P	7 × 0,68	0,70	4,10	1,80	19,80	227	0,83
2,5	∅	orange	5P	7 × 0,68	0,70	4,10	2,10	24,50	374	1,4
2,5	301986	orange	7P	7 × 0,68	0,70	4,10	2,20	26,80	450	1,56
2,5	301987	orange	10P	7 × 0,68	0,70	4,10	2,60	34,80	660	2,35

∅ = On request
P = Pair

BETAflam® Safety Power and Communication Cables

- German DIN VDE safety cables with circuit and system integrity E30, E60, E90, LSOH
- Swiss safety cables with circuit integrity E30, LSOH 

- Optimised fire protection properties
- Circuit and system integrity
- Halogen and silicone free
- No corrosive gases
- Low smoke density
- Irradiation crosslinked
- Universal use

(N)HXH-J FE180 / E90



(N)HXH-J FE180 / E30 - E60



N2XH-J



(N)HXH-J FE180 / E90



(N)HXH-J FE180 / E30 - E60



N2XCH



(N)HXCH FE180 / E90



(N)HXH-J FE180 / E30 - E60



NHXMH-J



(N)HXCH FE180 / E30 - E60



(N)HXCH FE180 / E30 - E60



JE-H(St)H FE180 / E30 - E90



J-H(St)H BMK red



JE-H(St)H FE180 / E30 - E90 BMK



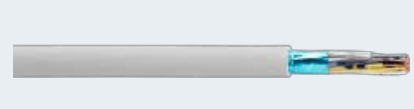
JE-H(St)HRH FE180 / E30 - E90 BMK



JE-H(St)H FE180 / E30



J-H(St)H grey



FE180 / E30



FE5



FE0



BETAfixss® Laying System

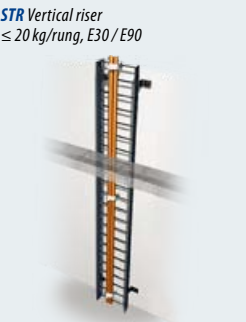
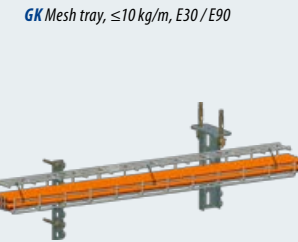
Certified cable laying system with system integrity in the event of fire

- Long laying distances
- Reduced cost of materials and installation
- Short fitting times
- High quality materials
- Cable and laying system from one source
- DIN 4102 part 12 tested and approved

3000 mm
Mounting distance



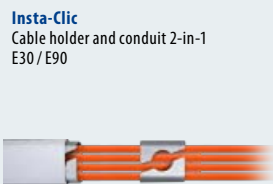
1500 mm
Mounting distance



1200 mm
Mounting distance



800 mm
Mounting distance



600 mm
Mounting distance



Accessories



Overview

Flexible **BETAtherm®** and **BETAflam®** Cables

– LSOH

– Universal industrial use

Single Core with increased environmental compatibility

- Flame retardant
- No flame propagation

BETAtherm® 90

≤ 1 mm² SO 05Z1-K, 300 / 500 V
 ≥ 1,5 mm² SO 07Z1-K, 450 / 750 V



BETAtherm® 110

≤ 1 mm² H05Z-K, 300 / 500 V
 ≥ 1,5 mm² H07Z-K, 450 / 750 V



BETAtherm® 145

≤ 1 mm² SO 05Z-K, 300 / 500 V
 ≥ 1,5 mm² SO 07Z-K, 450 / 750 V



BETAtherm® 145 UL / CSA

UL 3266 / CSA AWM I A/B 125 °C / 300 V
 UL 3271 / CSA AWM I A/B 125 °C / 600 V



Single Core with maximum resistance to temperature

- Flame retardant

BETAtherm® 155

≤ 1 mm² 300 / 500 V
 ≥ 1,5 mm² 450 / 750 V



BETAtherm® 155 UL / CSA

UL 3289 / CSA CL 1503 / 600 V



BETAtherm® smart-F

≤ 1 mm² 300 / 500 V
 ≥ 1,5 mm² 450 / 750 V



Multicore with increased environmental compatibility

- Flame retardant
- No flame propagation

BETAflam® 145 flex

450 / 750 V, temperature resistant



BETAflam® 145 C-flex

450 / 750 V, temperature resistant



BETAflam® CHEMAflex

450 / 750 V, oil and chemical resistant



BETAflam® CHEMA C-flex

600 / 1000 V, oil and chemical resistant



BETAflam® CHEMAflex R

300 / 500 V, oil and chemical resistant



BETAflam® CHEMA C-flex R

300 / 500 V, oil and chemical resistant



Shielded connection cable for motors

- EMC optimized
- With symmetrical conductor layout
- No flame propagation

BETAdrive C-flex

600 / 1000 V



Overview

Flexible BETAtans® Cables

- LSOH
- Rolling Stock applications
- Universal use

**Single Core
with increased dielectric
strength**

- Temperature resistant 120 °C
- Flame retardant

BETAtans® 3 GWK
1,8 / 3 kV



BETAtans® GWK R
volume optimised
300 / 500 V



BETAtans® 4 GWK-AXplus
1,8 / 3 kV



BETAtans® 4 GWK-AXplus C-flex
1,8 / 3 kV



BETAtans® 9 GWK-AXplus
3,6 / 6 kV



BETAtans® 9 GWK-AXplus C-flex
3,6 / 6 kV



Multicore

- Temperature resistant 120 °C
- Flame retardant

BETAtans® GWK flex R
300 / 500 V



BETAtans® GWK C-flex R
volume optimised
300 / 500 V



BETAtans® 3 GWK flex
0,6 / 1 kV



BETAtans® 3 GWK C-flex
0,6 / 1 kV



Single Core

- Temperature resistant 120 °C
- Flame resistant
- Insulation integrity

BETAtans® 3 GWK FE180 flex
0,6 / 1 kV



Multicore

- Temperature resistant 120 °C
- Flame resistant
- Insulation integrity

BETAtans® 3 GWK FE180 flex
0,6 / 1 kV



BETAtans® 3 GWK FE180 C-flex
0,6 / 1 kV



**Single Core
with increased dielectric
strength**

- Temperature resistant 120 °C
- Flame resistant
- Insulation integrity

BETAtans® 4 GWK-AXplus FE180 flex
1,8 / 3 kV



Technical information

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Current rating

Single Core / Single Insulated Cables, Conductor temperature 90 °C

with copper conductors, ambient temperature 30 °C

Cross section mm ²	Mode of laying In tubes, on or in wall or in closed conduits		free in air spaced	on surface spaced	Mode of laying on surface touching	Mode of laying Open laying on perforated trays or in air	
	2	3	2	2	3	2	3
	A	A	A	A	A	A	A
1,5	23	20	28	27	24	27	26
2,5	30	26	38	36	33	38	36
4	40	35	52	49	45	51	49
6	50	44	67	64	58	65	62
10	68	60	95	90	80	90	86
16	89	78	126	120	107	121	115
25	118	104	172	163	143	163	155
35	144	127	213	202	177	202	192
50	174	155	263	250	216	245	233
70	218	194	334	317	277	315	300
95	268	239	418	398	343	388	370
120	311	276	492	467	402	457	435
150	356	316	569	541	460	522	497
185	410	364	663	630	535	607	578
240	486	430	796	756	639	723	689
300	564	499	941	894	752	852	811
400	652	574	1108	1053	878	996	949
500	748	656	1297	1232	1028	1164	1109
630	854	745	1523	1447	1206	1367	1302

Valid for continuous operation.

For operating conditions different from the above, corrective factors must be taken into account (multiple cables, other load factors, ambient temperatures or multicore cables).

Conversion factors for grouping

Number	Factor	Factor	Factor	Factor
1	1,00	1,00	1,00	1,00
2	0,80	0,95	0,85	0,87
3	0,70	0,90	0,79	0,81
4	0,65	0,90	0,75	0,78
5	0,60	0,90	0,73	0,76
6	0,57	0,90	0,72	0,75
7	0,54	0,90	0,72	0,75
8	0,52	0,90	0,71	0,74
9	0,50	0,90	0,71	0,74

Current rating

Single Core / Double Insulated Cables, Conductor temperature 90 °C

with copper conductors, ambient temperature 30 °C

Cross section mm ²	Mode of laying In tubes, on or in wall or in closed conduits		free in air spaced	on surface spaced	Mode of laying on surface touching	Mode of laying Open laying on perforated trays or in air	
	2	3	2	2	3	2	3
	A	A	A	A	A	A	A
1,5	25	22	32	30	28	32	30
2,5	32	29	49	47	37	42	40
4	42	37	65	62	49	55	52
6	53	47	83	79	61	71	67
10	73	65	115	109	86	99	94
16	95	84	150	143	114	129	123
25	125	111	200	190	151	171	163
35	151	135	245	233	185	211	200
50	182	163	297	282	224	255	242
70	228	203	375	356	312	324	308
95	279	249	464	441	351	402	379
120	323	288	541	514	411	471	444
150	368	329	620	589	471	540	509
185	424	378	718	682	545	625	589
240	500	445	856	813	649	724	700
300	579	514	1003	953	760	869	820
400	669	592	1173	1114	890	1020	961
500	768	677	1366	1298	1039	1188	1121
630	877	770	1596	1515	1215	1390	1311

Valid for continuous operation.

For operating conditions different from the above, corrective factors must be taken into account (multiple cables, other load factors, ambient temperatures or multicore cables).

Conversion factors for grouping

Number	Factor	Factor	Factor	Factor
1	1,00	1,00	1,00	1,00
2	0,80	0,95	0,85	0,87
3	0,70	0,90	0,79	0,81
4	0,65	0,90	0,75	0,78
5	0,60	0,90	0,73	0,76
6	0,57	0,90	0,72	0,75
7	0,54	0,90	0,72	0,75
8	0,52	0,90	0,71	0,74
9	0,50	0,90	0,71	0,74

Current rating

Multicore Cables, Conductor temperature 90 °C

with copper conductors, ambient temperature 30 °C

Cross section mm ²	Mode of laying In tubes, on or in wall or in closed conduits	Mode of laying Clipped direct or laid in open troughs or ducts	Mode of laying Open laying on perforated trays or in air
	2 / 3 A	2 / 3 A	Number of energized cores 2 / 3 A
1,5	20	24	25
2,5	27	32	34
4	35	42	45
6	44	53	57
10	61	74	79
16	79	97	103
25	104	129	137
35	126	157	167
50	152	192	205
70	189	239	255
95	232	295	315
120	268	342	365
150	305	390	417
185	351	451	483
240	398	500	565

Valid for continuous operation.

For operating conditions different from the above, corrective factors must be taken into account (multiple cables, other load factors, ambient temperatures or multicore cables).

Conversion factors for grouping: Touching

Number	Factor	Factor	Factor
1	1,00	1,00	1,00
2	0,80	0,85	0,93
3	0,70	0,79	0,85
4	0,65	0,75	0,82
5	0,60	0,73	0,78

Conversion factors for grouping: Spaced $1 \times \varnothing$

Number	Factor	Factor	Factor
1	1,00	1,00	1,00
2	0,85	0,90	0,98
3	0,75	0,84	0,96
4	0,70	0,80	0,95
5	0,66	0,76	0,94

Current rating

Conversion factors

Ambient air temperature 30 °C / Free in air / Conductor temperature 90 °C

0 °C	5 °C	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
1,23	1,19	1,16	1,12	1,08	1,04	1,00	0,96	0,91	0,87	0,82	0,76	0,71

Duct in soil / Ambient soil temperature 20 °C / depth of laying 0,5 m / Conductor temperature 90 °C

0 °C	5 °C	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
1,13	1,10	1,07	1,04	1,00	0,96	0,93	0,89	0,85	0,80	0,76	0,71	0,66

Conductor temperature 90 °C

40 °C	50 °C	60 °C	70 °C	80 °C	90 °C	100 °C	110 °C	120 °C
0,67	0,74	0,82	0,89	0,94	1,00	1,06	1,11	1,16

Core identification

Hong Kong Colour Code (current)

Core numbers	Core function	Without Green/Yellow core	With Green/Yellow core
1	1C	Red, Yellow, Blue, Black	Green/Yellow
2	2C	Black, Red	
3	2C+E		Black, Red, Green/Yellow
	3C	Red, Blue, Yellow	
4	3C+E		Red, Blue, Yellow, Green/Yellow
	4C	Black, Red, Blue, Yellow	
5	4C+E		Black, Red, Blue, Yellow, Green/Yellow
	5C	White, numbered from inside to outside	
≥6	...C	see footnote ¹	
	...C+E		see footnote ¹

Core Colours:

- Phase: Red, Yellow, White, Blue
- Neutral: Black
- Earth: Green/Yellow

¹ With 6 or more conductors the phase cores are of white colour and black numbering, numbering sequence from the inside to the outside. The earth conductor is always the last and the neutral conductor the second last core of the outer layer.
The numbering sequence of the stranded conductors shall be the same at any cut end of the cable.

Core identification

European Harmonised Colour Code DIN VDE 0293-308; CENELEC HD 308 S2; BS 7671:2001 (on request)

Core numbers	Core function	Without Green/Yellow core	With Green/Yellow core
1	1C	Black	Green/Yellow
2	2C	Blue, Brown	
3	2C+E		Green/Yellow, Blue, Brown
	3C	Brown, Black, Grey	
4	3C+E		Green/Yellow, Blue, Brown, Black
	3C+E		Green/Yellow, Brown, Black, Grey
	4C	Blue, Brown, Black, Grey	
5	4C+E		Green/Yellow, Blue, Brown, Black, Grey
	5C	Blue, Brown, Black, Grey, Black	
≥6	...C	see footnote ²	
	...C+E		see footnote ²

Core Colours:

- Phase: Brown, Black, Grey
- Neutral: Blue
- Earth: Green/Yellow

- ² With 6 or more conductors the phase cores are of Black colour and White numbering, sequence from the inside to the outside. The earth conductor is always the last and the neutral conductor the second last core of the outer layer.
The numbering sequence of the stranded conductors shall be the same at any cut end of the cable.

Environmental and Fire Performance

Halogen free

The halogens are the elements of the 7th group in the Periodic Table of Elements: chlorine (Cl), fluorine (F), bromine (Br), iodine (I).

Halogen free cables must be free of chlorine, fluorine and bromine (PVC cables contain halogen, PVC = Polyvinylchloride).

The halogens are an integrated component of many acids

- HCl = Salt acid (hydrochloric acid)
- HF = Hydrogenfluorid
- HBr = Hydrogenbromid

The most popular plastic containing halogens is PVC (polyvinylchloride). In case of fire or at high temperature PVC starts to degradate. Hydrochloric acid and other fission products are generated and leads to extremely aggressive corrosion. Therefore the current trend is to replace the halogen containing plastics with halogen free ones. For instance PVC is currently being replaced at a large scale with polyolefin i.e. polyethylene.

Thanks to halogen free cables the formation of corrosive and toxic gases can be prevented.

Test procedures

1000 mg of the testing material must be fixed at one termination of an annealed copper wire in a gas flame.

Requirement

The material is considered to be halogen free if no green to blue-green flame discoloration occurs. The chlorine and the bromine would cause such a discoloration, however the existence of fluorine cannot be proven like that.

Test standards

IEC 60754-1; BS EN 50267-2-1; VDE 0482-267-2-1

Degree of acidity of combustion gases

Corrosive gases act with moisture to produce aggressive acids which corrode metal parts and cause extensive long-term damage, even though the fire damage may only be limited; this is because corrosive gases often spread throughout a building through the ventilation system or withing installation system. The damage may not be limited to the area immediately affected by the fire. Electronic units and electronic contacts are particularly endangered, as are free-standing or concrete enclosed steel constructions.

Test procedures

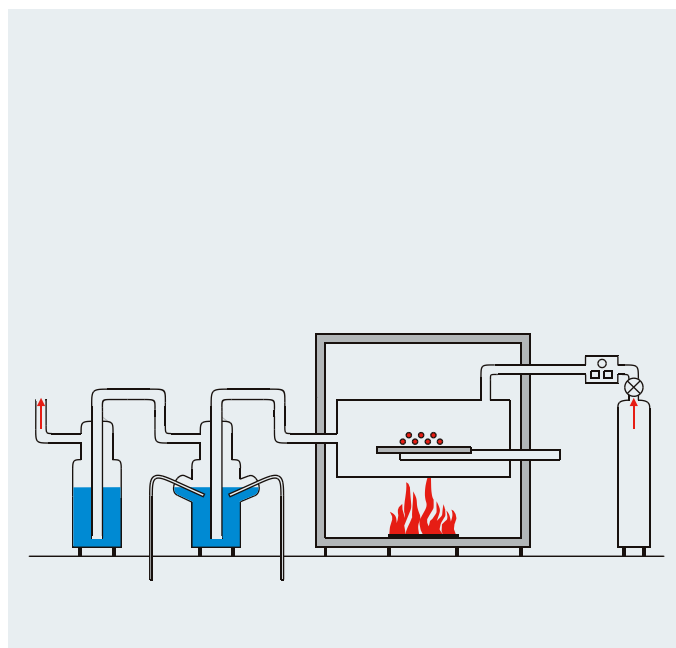
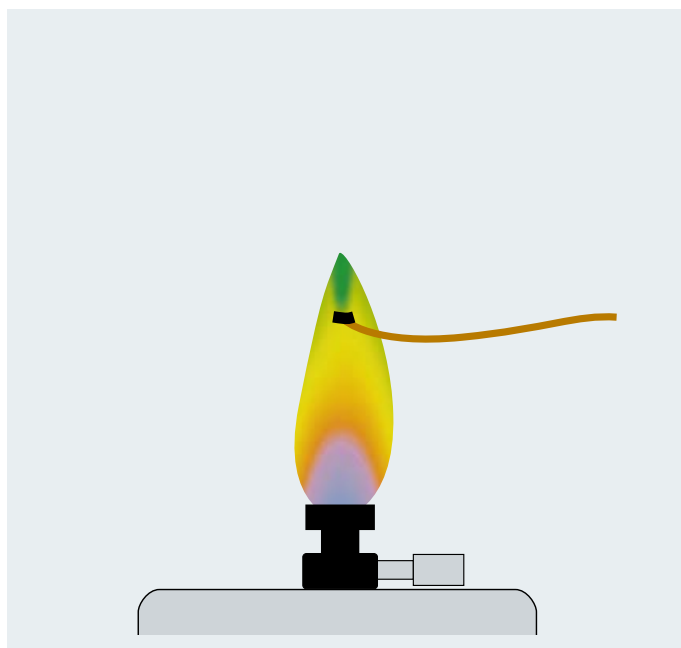
1000 mg insulation material is burned in a combustion furnace at $\geq 935^\circ\text{C}$ with pre-defined air supply for over 30 minutes. By means of two gas washing containers, held in the airflow the conductivity and the pH-value are measured. Like that even small quantities of halogen containing substances can be detected and proven.

The test is considered to be passed when

- the ph-value $> 4,3$
- the conductivity $< 10 \mu\text{S}/\text{mm}$

Test standards

IEC 60754-2; BS EN 50267-2-2; VDE 0482-267-2-2



Smoke density

The formation of smoke has several unpleasant consequences. On one hand it considerably lowers the visibility in a fire event, thus endangering the people trapped inside closed rooms escape of and the efforts of the firemen to carry on their rescue and fire fighting actions. On the other hand it produces smoke poisoning because of the carbon monoxide. Regarding the formation of the combustion gases the PVC comes off quite badly.

Test procedures

The density of smoke emission can be determined by measuring of the light penetrability. Cable samples are lit with alcohol in a test chamber (cubical with an edge length of 3 m). The so formed smoke is uniformly spread by a ventilator and influences the light measuring section.

The test is considered to be passed when the following light penetrability is reached:

Dangerous level	Requirements
HL 1	–
HL 2 and HL 3	60 %
HL 4	70 %

Test standards

IEC 61034-1/-2; BS EN 61034-1/-2; VDE 0482-1034-1/-2

Flame retardant

Flame retardant cables are cables which, when installed as a single cable, although ignitable on exposure to flame source, will greatly reduce flame spread and self-extinguish once the flame source is removed.

However in a vertical cable bundle, e.g. in vertical risers, fire can spread along the cables (chimney effect). In order to avoid this danger, the so called «no flame propagating» cables should be used.

Test procedures

This test procedure describes the minimum requirements for flame retardant cables and it is valid for lead wires or on single cables only.

A lead wire or a cable is being aflamed with a propane-air-burner (1 kW flame).

Test duration

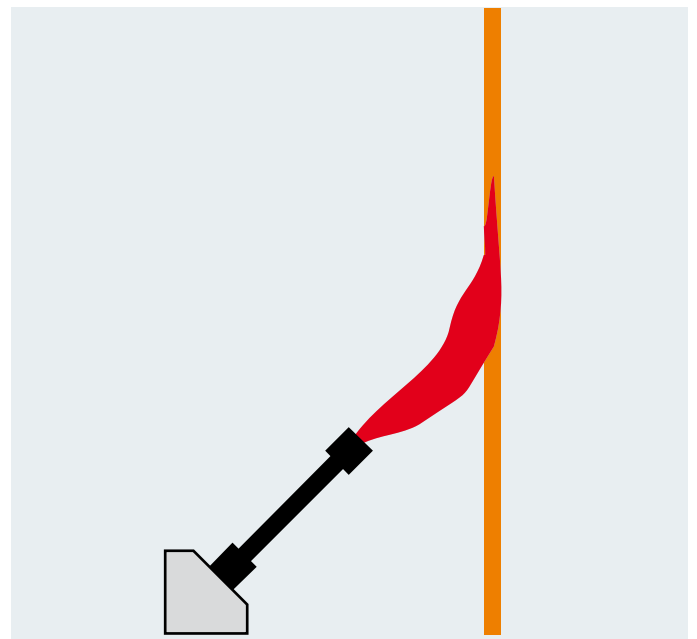
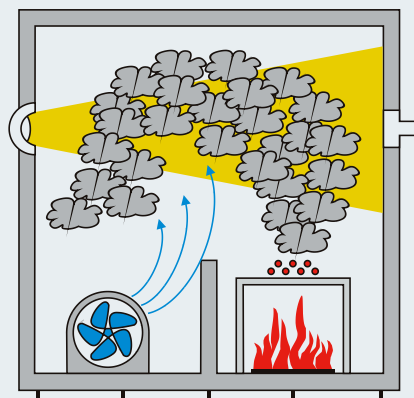
- $\varnothing \leq 25$ = 60 s
- $\varnothing 25 \dots 50$ = 120 s
- $\varnothing 50 \dots 75$ = 240 s
- $\varnothing > 75$ = 480 s

The burning cable should self-extinguish as soon as the fire source has been removed. The fire damage may not be higher than 60 cm.

The test is considered to be passed if the sample has not burned and the damage (carbonisation) has not reached any of the terminations of the sample (> 50 mm).

Test standards

IEC 60332-1, EN 60332-1, VDE 0482-332-1,
BS 6387:1994 clause 10, BS EN 60332-1



No flame propagation

No flame propagating cables are those which can be ignited by a flame source, however they do not allow the fire to spread even if the cable bundle is placed vertically; they are self extinguishing once the fire source is removed.

Test procedures

This test simulates the chimney effect in vertical cable installations. In a standardized cabinet the cable bundle is kept in a burner fire for 20 - 40 minutes (gas burner 75 ± 5 MJ/h). Thereby the temperature is kept constant at 750 °C. Depending on the volume of the non-metal (combustible) materials per running meter it can be differentiated in the categories A F/R, A, B, C und D as follows.

Category	A F/R	A	B	C	D
■ Liter (dm ³) of insulation material per 1 m sample	7	7	3.5	1,5	0,5
■ Aflame time (min)	40	40	40	20	20

The cables must self-extinguish after removing the fire source. The fire may not have propagated any further than 2,5 m from the burner. With the cables of LEONI Studer AG this should reach no further than 50 to 60 cm.

Test standards

Category	IEC	EN	VDE 0482
A F/R	60332-3-21	60332-3-21	part 266-2-1
A	60332-3-22	60332-3-22	part 266-2-2
B	60332-3-23	60332-3-23	part 266-2-3
C	60332-3-24	60332-3-24	part 266-2-4
D	60332-3-25	60332-3-25	part 266-2-5
Apparatus	60332-3-10	60332-3-10	part 266-1

Circuit integrity under fire

The circuit integrity indicates, how long a free cable retains its isolation in a fire without causing a short-circuit. According to its international standard, a cable is laid horizontally over a burner for three hours. The temperature is set at 750 °C. The circuit integrity is designated with FE (e.g. FE180 = circuit integrity of 180 min): BETAflam FE180 / E30

Test procedures

The sample is fastened at defined distances above the burner. The conductor is connected to a power source at nominal voltage via an 2 A fuse.

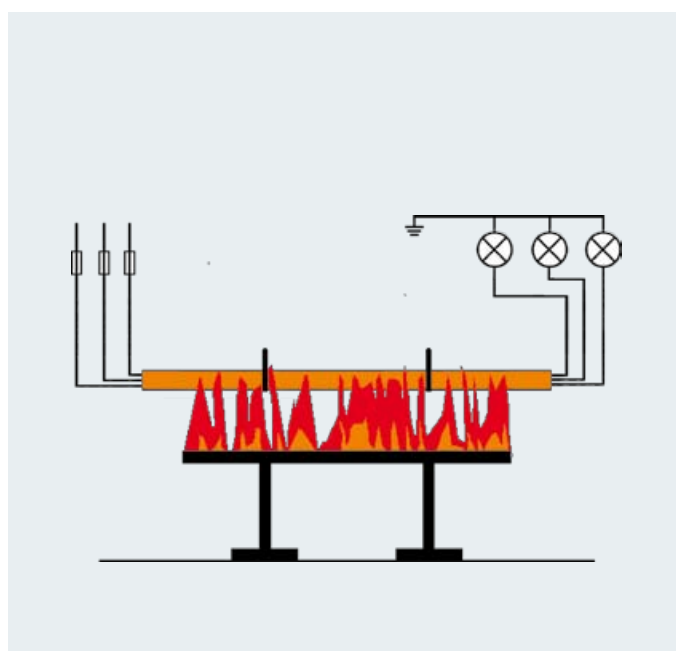
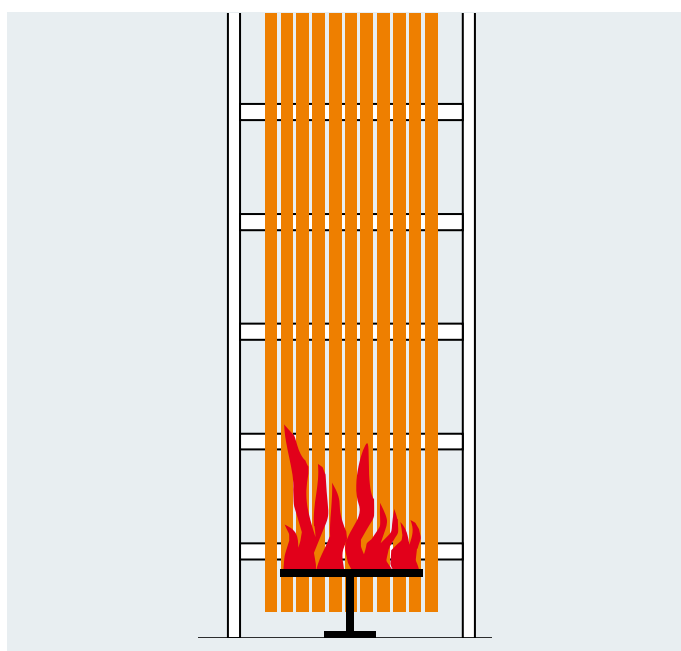
The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standards

DIN VDE 0472-814

IEC 60331-11 Apparatus 750 °C

IEC 60331-21 Cables rated up to 0,6 / 1,0 kV



Circuit integrity with mechanical shock

Cables for emergency circuits up to 20 mm diameter are subject and tested to fire with mechanical shock during a survival time of maximum 90 minutes.

Test procedures

A single cable is fixed to a test panel under conditions of minimum bending radii and is tested at a minimum test temperature of 830 °C and impacts on the test panel supporting the cable. During the test no rupture of conductors shall appear and voltage must be maintained.

For the purposes of the European Construction Products Directive, the survival time serves to classify the cables into PH classes.

The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standards

DIN EN 50200, classes PH 15, 30, 60, 90

VDE 0482-200

IEC 60331-12 Apparatus 830 °C

IEC 60331-31 Fire with shock, up to 0,6 / 1,0 kV

System integrity

Maintaining the functionality of cable installations in event of fire. The test involves the cable and the laying resp. fastening system.

Test procedures

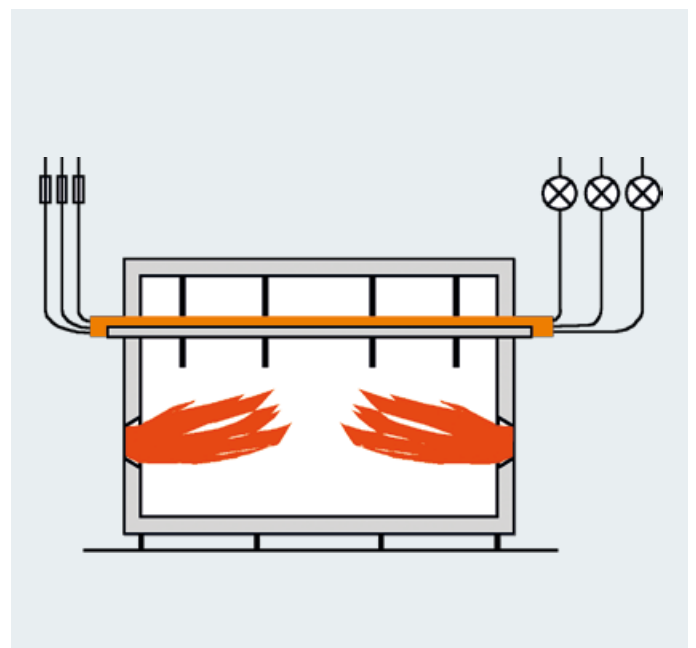
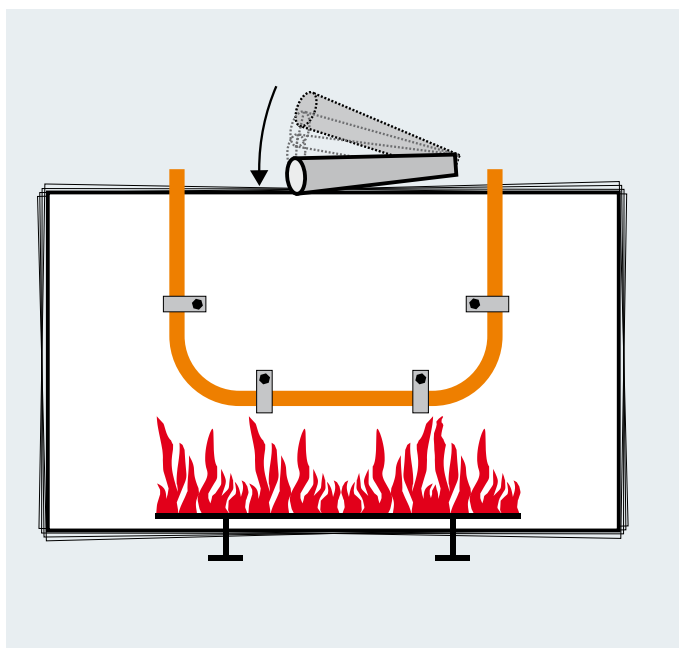
The cables are installed with the laying/fastening system in a testing oven with a minimum length of 3 m. The conductors are connected to a 400 V (for control cables 110 V) power source and fused with 2 A.

The heat induced increase in conductor resistance is not taken into account during the test.

The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standard DIN 4102 part 12:1998-11

- E30 850 °C to 900 °C for 30 min
- E60 850 °C to 970 °C for 60 min
- E90 850 °C to 1000 °C for 90 min



Resistance to fire alone

When the cable sample is tested, no fuse shall be ruptured nor any lamp extinguished during the period of the test.

Test procedures

The cable is held horizontally by suitable clamps and adjusted to the metal support rings above the burner.

Each conductor is connected to a transformer output with a 3 A fuse and adjusted to the rated voltage.

The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standard BS 6387:1994

- Test A 650 °C for 3 h
- Test B 750 °C for 3 h
- Test C 950 °C for 3 h
- Test S 950 °C for 20 min

Resistance to fire with water

When the cable sample is tested, no fuse shall be ruptured nor any lamp extinguished during the period of the test.

Test procedures

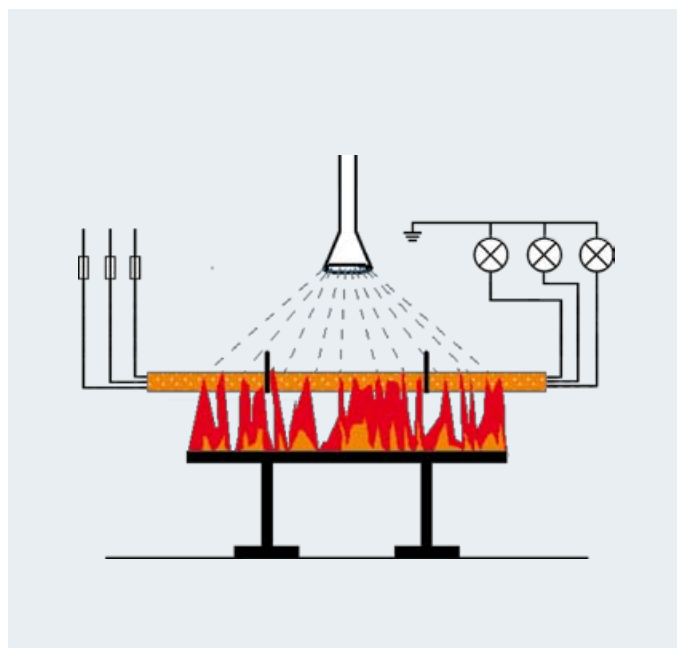
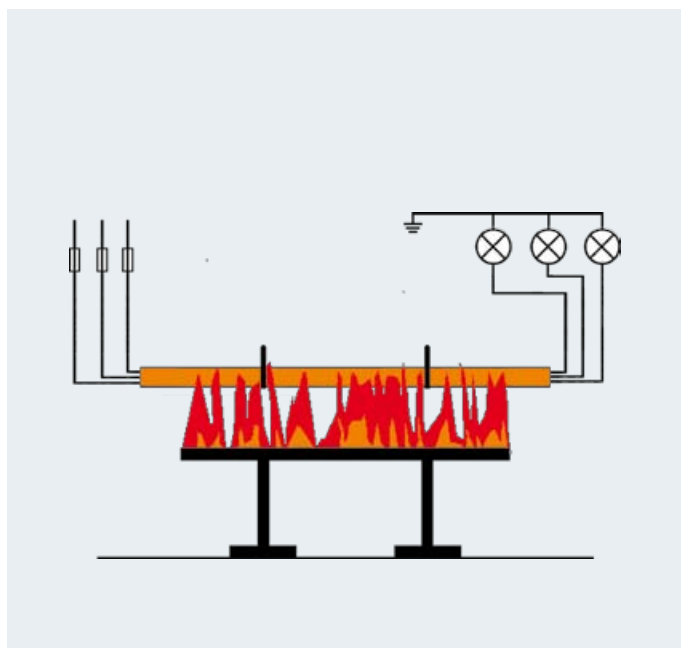
The cable is held horizontally by suitable clips above the burner.

Each conductor is connected to a transformer output with a 3 A fuse and adjusted to the rated voltage.

The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standard BS 6387:1994

- Test W 650 °C for 30 min
 - first 15 min burner only
 - second 15 min burner with water sprinkler turned on



Resistance to fire with mechanical shock

When the cable sample is tested, no fuse shall be ruptured nor any lamp extinguished during the period of the test.

Test procedures

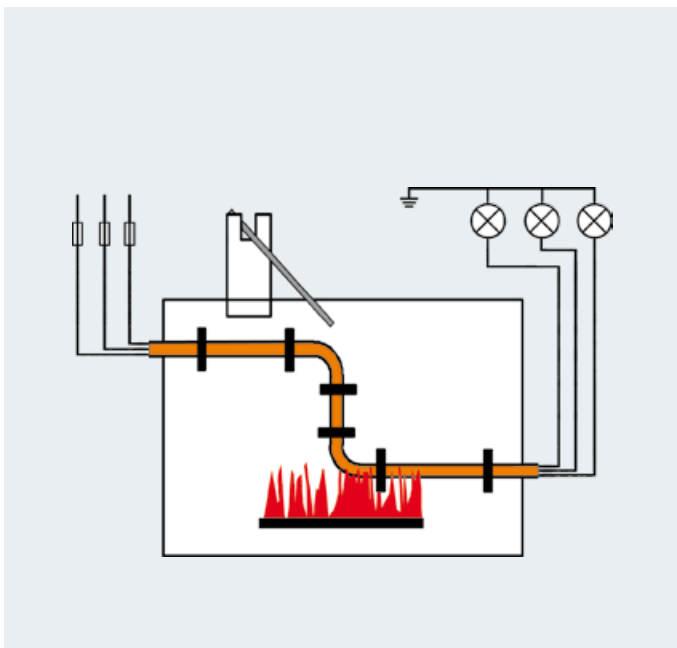
The cable is bent and mounted to the vertical wall using clips.

Each conductor is connected to a transformer output with a 3 A fuse and adjusted to the rated voltage.

The test is considered to be passed, if during the test no short circuit or circuit interruption occurs.

Test standard BS 6387:1994

- Test X 650 °C for 15 min
- Test Y 750 °C for 15 min
- Test Z 950 °C for 15 min



Summary of standards

Requirements	International IEC	Europe CENELEC	Germany VDE	others
Halogen free	IEC 60754-1	BS EN 50267-2-1	VDE 0482-267-2-1	NF C20-454
No corrosive gases	IEC 60754-2	BS EN 50267-2-2	VDE 0482-267-2-2	NF C20-454
No toxic gases		BS EN 50267-2-1		NES 02-713; NF C20-454
Low smoke density – Armoured cables	IEC 61034-1 and 2	BS EN 61034-1 and 2	VDE 0482-1034-1 and 2	BS 61034-2 BS 7846
Flame retardant	IEC 60332-1	BS EN 60332-1	VDE 0482-332-1	BS 60332-1
No flame propagation – Flame spread	IEC 60332-3-21 (AF/R)	EN 60332-3-21	VDE 0482-266-2-1	
	IEC 60332-3-22 (A)	EN 60332-3-22	VDE 0482-266-2-2	
	IEC 60332-3-23 (B)	EN 60332-3-23	VDE 0482-266-2-3	
	IEC 60332-3-24 (C)	EN 60332-3-24	VDE 0482-266-2-4	
	IEC 60332-3-25 (D)	EN 60332-3-25	VDE 0482-266-2-5	
Circuit integrity				
– FE180	IEC 60331-21		VDE 0472-814	BS 6387 C
– With mechanical shock	IEC 60331-31	EN 50200 / EN 50362	VDE 0482-200	BS 6387 Z
– With water sprinkler				BS 6387 W
System circuit integrity			DIN 4102 part 12 E30, E60, E90	
Limited Oxygen Index	ASTM D 2863	EN ISO 4589-2		NES 714

Duration of system circuit integrity in the building laws

The duration of the system circuit integrity depends on how long the supply of electrical services must continue in the event of a fire. National legislations in most countries provide requirements for safety systems which have to be met.

Evacuation

In many countries a duration of 30 minutes is considered sufficient for alarm and evacuation of people.

Compliance with this requirement with regard to the systems (fire alarm systems, emergency lighting, passenger hoists, smoke exhaust, voice alarm and acoustic signalling, escape route signalling) can be achieved by means of a «Class E30» cable system.

For special buildings like high-rise buildings, hospitals, shopping centres, tunnels, prisons, a duration of 60 to 90 minutes can also be adequate. In this case a «Class E60» or even «E90» cable system could be required (e.g. for the supply of lifts for in-patients etc.).

Fire fighting

Besides rescuing time for people extra time for the work of the fire brigades must be allocated. Mostly 90 minutes after the fire starts are regarded sufficient for fire fighting. The uninterrupted power supply of the electrical systems used for this (e.g. sprinkler water pumps, mechanical smoke exhausts, firemen lifts) can be attained with «Class E90» cable systems.

Planning

Planning an electrical safety system means finding answers to the questions:

- Which parts of the building requires which level of safety?
- Which electrical system has to operate for how long?
- Which circuits are involved (safety circuits)?
- Which is the best cable routing for these circuits?
- Are there restrictions concerning fire load, etc.?

Only then the selection of appropriate cables and support systems can begin.

General Conditions of Sale and Delivery of LEONI Studer AG, Däniken

Valid July 2007 (replaces all previous versions)

Unless agreed to the contrary, the following conditions shall apply to all deliveries:

1. Conclusion of contract

- 1.1 These General Conditions of Sale and Delivery shall be deemed to be accepted at the latest upon acceptance of our goods. Amendments to any of these Conditions of Sale and Delivery shall be invalid unless confirmed by LEONI Studer AG in writing.
- 1.2 All our offers are prepared on the basis of the details or planning materials placed at our disposal or transmitted to LEONI Studer AG. Our offers shall no longer be binding if details, dimensions or plans are subsequently amended. Unless otherwise agreed in writing, the prices and conditions offered shall remain valid only as long as the raw material costs remain unchanged; increases in the prices of raw materials occurring before the definitive award of the contract will be charged additionally. Brochures and catalogues shall not be binding unless agreed elsewhere in writing. Details contained in technical documentation shall only be binding if they have been expressly promised by LEONI Studer AG in a separate written contract.
- 1.3 An order shall only be valid upon confirmation by us in writing. If the goods ordered are on stock, the order shall be deemed to be accepted if it is received by LEONI Studer AG and not refused within one working day; basic agreement orders remain reserved. Our confirmations of order shall be checked in detail. Any discrepancies must be notified to LEONI Studer AG within three working days at the latest after the date of the confirmation of order. Silence on the part of the purchaser until the expiry of this period shall be deemed to be acceptance of our order confirmation. After expiry of this period, we shall be free to manufacture and invoice the goods ordered in accordance with the order confirmation.
- 1.4 Any requests for changes received after the contract has been concluded may only be taken into account if we are able to agree to a change in the light of the state of the preliminary works. The costs and delivery delays resulting from such subsequent changes shall be borne by the purchaser.
- 1.5 If any of the provisions of these Conditions of Sale and Delivery shall prove to be null and void or non-binding in whole or in part, such nullity or non-binding character shall only apply to the provision concerned. Such null and void or non-binding provision shall be replaced by such substitute solution that comes closest to the intended purpose of the null and void or non-binding provision in question.

2. Termination of contract by the supplier

If LEONI Studer AG wishes to terminate the contract, it shall inform the purchaser immediately after discovery of the significance of the event; this shall also apply if an extension of the delivery period has initially been agreed. In the event of a termination of the contract, we shall be entitled to remuneration for those deliveries and services already rendered. The purchaser shall not be entitled to any claims for damages by virtue of such termination of contract.

3. Exclusion of further liability of the supplier and consequential losses

The cases of substantial breach of contract, the legal consequences thereof and all claims by the purchaser for whatever legal reason are regulated definitively in these Conditions. In particular all claims for damage, diminution, termination of the contract or withdrawal from the contract not expressly specified shall be excluded. In no case shall the purchaser be entitled to claims for compensation for damage which has not been incurred by the delivered item itself, such as loss of production, loss of use, loss of orders, lost profit and other direct or indirect losses. These restrictions shall not apply in the case of unlawful intent or gross negligence on the part of LEONI Studer AG, but they shall also apply in the case of unlawful intent or gross negligence on the part of auxiliary personnel.

4. Supplier's right of recourse

Should any person be injured or third party property be damaged as a result of the

acts or omissions of the purchaser or its auxiliary personnel, and should claims be made against LEONI Studer AG on this basis, the latter shall have a right of recourse against the purchaser.

5. Order quantity

- 5.1 Shortage- or excess lengths of +/- 10 % are permitted.
- 5.2 We are allowed to deliver in different part lengths, because of production and commercial reasons. The accuracy of measuring is +/- 0.5%.

6. Details of dimensions and weight and structural variations

All details of diameters and weights of products are without obligation and are approximate. We reserve the right to make variations in the structure of products for production or raw material reasons.

7. Prices

- 7.1 The prices for deliveries within Switzerland are exclusive of VAT, without spools but with packaging, carriage paid to the recipient for rail parcels or to the Swiss destination station for wagonloads. For deliveries up to 30 kg by post or parcel service, the purchaser shall be charged for the entire postage. For small quantities an additional processing fee will be charged based on the actual valid price list.
- 7.2 The prices for deliveries abroad are ex works (Incoterms 2000), including packaging and non-returnable packing containers plus applicable taxes and other levies. If dispatched on spools of Kabeltrommel GmbH & Co. KG, D - 51005 Cologne (KTG), the provision of Art. 12.3 shall be complied with. The list of prices for deliveries abroad include a fixed basic metal price which may vary in the individual product segments. The calculation basis for the metal selling price shall be the price on the relevant metal exchange on the day preceding the receipt of the order. A metal cost procurement supplement may be charged. The selling price shall be increased or reduced by the difference between the basic metal price and the metal exchange price.

8. Terms of payment

- 8.1 The period of payment shall be 30 days net for all deliveries after date of invoice. Deductions of discounts without entitlement shall be reclaimed.
- 8.2 We reserve the right to request payment in advance and immediate payment.
- 8.3 In the event of a delay in payment, we reserve the right to withhold planned deliveries and to charge interest on arrears at the usual bank discount rate applicable at the place of our company's head office, at least, however, 0,6 % per month.
- 8.4 Payments shall be made by the purchaser to our domicile in cash or by bank transfer free of deductions for charges, taxes or fees, and excluding set-off against other claims. In the case of payment by cheque or bill of exchange, the collection charges, the discount charges and interest shall be refunded to us.
- 8.5 The date of payment shall be deemed to be the date on which the money is at our disposal.
- 8.6 In the event of a failure to comply with our terms of payment for goods supplied, we reserve the right to withdraw from the contract (Swiss Code of Obligations, art. 214).

9. Delivery period and delivery delay

- 9.1 The delivery dates confirmed by us shall be ex Däniken works and shall be specified such that they can normally be met. A delivery delay resulting from force majeure, operating interruptions, difficulties in the procurement of materials and the like shall not entitle the purchaser to withdraw from the contract nor represent grounds for compensation for direct and indirect losses caused by the delay.
- 9.2 The purchaser shall be entitled to claim compensation for delays which are demonstrably due to our fault and where the purchaser can furnish evidence of

direct losses resulting from this delay. If the purchaser receives a substitute delivery, the claim for compensation for delay shall be forfeit.

- 9.3 Compensation for delay shall amount to 0,5 % for each full week of the delay, and shall be limited to a total of 5 % of the contractual price for the delayed part of the delivery. The first two weeks' delay shall not give rise to any claim to compensation for delay.

10. Dispatch, transport and insurance

- 10.1 Special wishes concerning dispatch, transport and insurance shall be notified to us in good time. Transport shall always be at the purchaser's risk. Complaints in connection with the dispatch or transport shall be addressed by the purchaser to the last haulage contractor without delay after receipt of the delivery or the freight documents; the goods being complained of are to be accepted with reservations.
- 10.2 The purchaser shall be responsible for insurance against damage of any kind.

11. Transfer of benefit and risk

- 11.1 Benefit and risk shall pass to the purchaser when the consignment (goods and packaging) leave the works or are ready for dispatch or collection, even if the place of dispatch is not the place of performance.
- 11.2 If dispatch is delayed at the purchaser's request or for other reasons for which we are not responsible, the risk shall pass to the purchaser at the time originally intended for delivery ex works. From this time on, the deliveries shall be stored and insured at the purchaser's cost and risk.

12. Loaned spools and packaging

- 12.1 Cardboard, plastic and paper packaging is included in the price for all deliveries.
- 12.2 For deliveries within Switzerland, dispatch spools will be made available to purchasers free of charge for a maximum of 6 months from the date of delivery. The loaned spools shall be returned at our expense either by LEONI Studer AG's own trucks, by hauliers authorised by LEONI Studer AG or by Cargo Domizil. The spools must be in good condition. The purchaser shall be liable for loss or damage. After expiry of the 6 months period, we shall send a reminder concerning the loaned spools, after which they shall be charged to the purchaser.
- 12.3 If delivery is made on the spools of KTG, KTG shall charge for the spool rental directly in accordance with their conditions. After becoming free, these spools shall be notified to KTG as being free. The appropriate conditions of KTG shall be deemed to be an integral part of our General Conditions of Sale and Delivery and shall be sent on request.

13. Warranty / complaint

- 13.1 The purchaser shall examine the objects delivered immediately upon arrival for shortages and obvious defects. These shall be notified in writing within 10 days after arrival of the goods, with details of the order and delivery note number, failing which no right may be derived from such defects.
- 13.2 If significant defects are established or if a test shows that the agreed construction conditions have not been fulfilled, we shall supply a replacement free of charge within a reasonable period of time, provided that we are responsible for the faults.
- 13.3 For all LEONI Studer AG cables, we warrant a perfect finish of the material supplied for a period of two years. The warranty shall begin upon dispatch of the delivery ex works or with start-up if we are responsible for installation. In particular, we assume the following liability for defects: all faults for which we are responsible and which are reported to us within the said period without delay and which under normal conditions with proper handling have led to disruption shall be remedied as quickly as possible at our expense by means of repair or replacement of the defective part. The parts replaced shall become our prop-

erty. However, we shall only be responsible for such faults as shall be demonstrably attributable to material defects or faulty workmanship of LEONI Studer AG. If the laying did not take place through our personnel or under our supervision, or if fittings of third-party origin are incorporated in the cables by the purchaser, we shall, in case of doubt, be entitled to regard third-party fault as the cause of the disruption. We shall not accept any claims based on the faults beyond the obligation to replace as described above, in particular claims for compensation for indirect losses. In the event that a defective stretch of cable is replaced, the warranty does not apply to the remaining network. More extensive claims for direct or indirect losses shall be excluded.

14. Returns

Goods returned for reason of non-use, unsuitable length etc. shall only be accepted on the basis of a prior written agreement. Expenses incurred shall be deducted from credit notes. No credit can be given for goods not in accordance with the catalogue, goods supplied according to particular specifications, goods used rarely or no longer, or incomplete goods or goods no longer in perfect condition.

15. Laying and installation

If laying and installation are an integral part of our scope of performance, they shall be carried out in accordance with separate installation conditions. The liability shall apply in each case only to such parts as are supplied by us, except for a faulty installation of the equipment or parts of the equipment caused by us.

16. Proprietary rights

Technical materials such as drawings, descriptions, illustrations and the like are our intellectual property and may be neither copied nor reproduced nor made available to third parties or rival companies without our express consent. The purchaser shall bear all risks if third party proprietary rights are infringed by a delivery according to its drawings or other details.

17. Reservation of title

- 17.1 We reserve title to the delivery until it has been paid in full. The purchaser shall be obliged to take the measures necessary for the protection of our title.
- 17.2 We shall be entitled to have the reservation of title entered in the appropriate register with the co-operation of the ordering party.

18. LEONI Social Charter

The purchaser is obligated to respect the Declaration on Social Rights and Industrial Relationships at LEONI (LEONI Social Charter). The purchaser has access to the LEONI Social Charter via the website of LEONI (www.leoni.com) or may request a copy of the LEONI Social Charter from LEONI Studer AG at any time. Any serious infringement or recurrent infringements of the LEONI Social Charter by the purchaser establishes the right of LEONI Studer AG to termination without cause and notice for individual as frame contracts with the purchaser.

19. Applicable law and legal venue

- 19.1 Swiss substantive law shall apply to the exclusion of the UN-Convention on Contracts for the International Sale of Goods.
- 19.2 The legal venue for all disputes in connection with this contract shall be Olten, Switzerland. However, we also reserve the right to assert our rights at the purchaser's domicile.

Däniken, July 2007

Further products

BETAtherm[®]

- Premium, halogen free and electron-beam cross-linked lead wires
- Temperature resistant, increased dielectric strength, easy stripping

BETAflam[®] flex

- Premium flexible connection and power cables
- Good resistance to aggressive media, halogen free and flame retardant

BETAflam[®] CHEMAflex[®]

- Oil and chemical resistant connection and power cables
- Temperature resistant, halogen free, flame retardant, easy stripping

BETAtrans[®]

- Premium flexible halogen free connection and power cables
- Excellent mechanical and dielectric strength

BETAflam[®] Solar

- Double insulated lead wires
- Electron-beam cross-linked and halogen free
- For solar power applications

BETAjet[®]

- 400 Hz ground power cable systems
- For mobile and static applications

BETAlux[®]

- Media resistance 5 kV-primary cables
- Feeder cables for airfield lighting

BETAflam[®]

- German Fire safety cables according DIN VDE 0266 / 0815 and DIN 4102 part 12
- British Fire safety cables according IEC, VDE, EN and BS
- Swiss Fire safety cables according SEV TP20B / 3C

BETAfixss[®]

- Laying systems

BETApower

- Medium voltage cables TRI-DELTA[®]
- Low voltage cables GKN and GN-CLN
- Low voltage cables **BETAflam**[®] TRAF0-FLEX
- Accessories for cables

BETAsolution[®]

- We are always at your disposal – cable management as complete support



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